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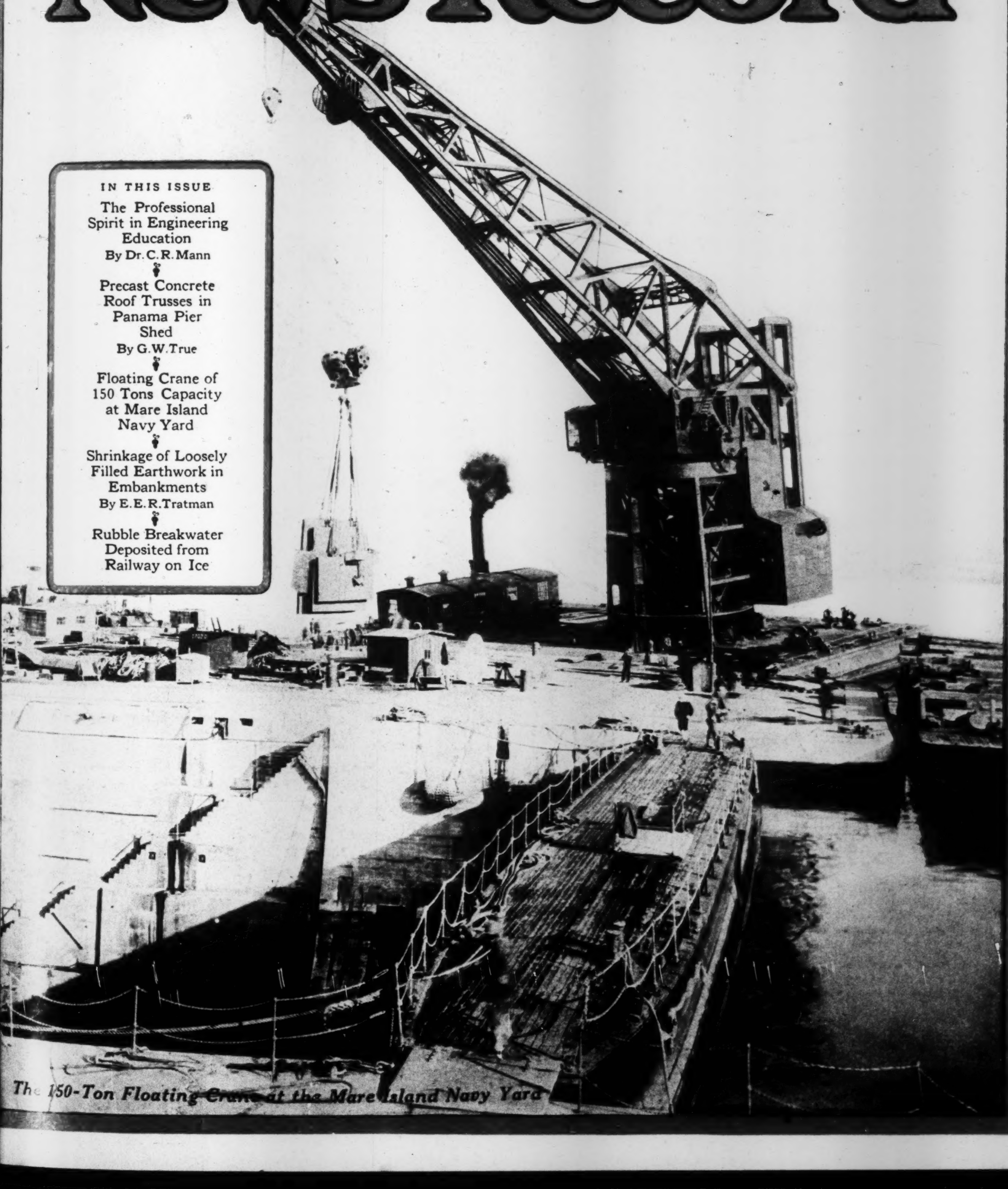

The 150-Ton Floating Crane at the Mare Island Navy Yard

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN
Editor

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A Public Works' Function

TULSA, a growing city in Oklahoma, proposes to establish a municipal system of garbage and refuse collection in place of the present haphazard collection by "every man who owns a donkey or burro." Thus far the project is sound, but the proposal to have the work done by the health department is unsound. Such operations should be conducted by the public works not the health department, both because of their small relation to health and because functionally the operation of public services belongs to the works of the engineering department of a city.

Does Earthwork Shrink?

OPINION representing the majority of engineers answers "yes" to the question, "Does Earthwork Shrink?" Nevertheless, a small but persistent voice says "no," and proceeds to intimate that majority opinion is not based upon exact knowledge—an intimation which seems to be supported by facts. From the extended review of the subject on p. 1256 it appears that there is a reduction of quantity between excavation and fill which reduction is commonly termed shrinkage, but to which a number of factors contribute. That review indicates that there are conditions which bear important relations to construction work and to both construction and valuation quantities. It suggests also the opportunity for scientific engineering research and experiment to determine the relative values of the several factors as well as the fact and extent of actual shrinkage of excavated material deposited in a fill.

Engineers as Railway Executives

A SURPRISING number of appointments of railway engineers to positions outside of their own departments seems to indicate a growing appreciation of the fact that the engineer is fitted especially by his training and experience to deal with problems other than those of his strictly technical work. As examples of the movement it may be noted that engineers hold the positions of president on the Chicago & Northwestern, Grand Trunk, Great Northern, Chicago & Western Indiana, Delaware & Hudson and Pere Marquette; vice-president on the Illinois Central, Rock Island, Norfolk & Western, Philadelphia & Reading and Central of Georgia; assistant to president on the Burlington, New York Central. Union Pacific, Chicago & Northwestern, Erie, Southern, Central of New Jersey, Missouri Pacific, Minneapolis & St. Louis and others. In these and other analogous positions, the engineer has to act in an executive or advisory capacity with broad problems of railway affairs and with such matters as wages, rates, valuation, budget making and transportation or operating difficulties. On some roads, the chief engineer retains his title but deals largely with the matters noted above, having an assistant chief engineer to handle the bulk of the technical and routine matters of the department. In the above lies a strong argument for the appointment of engineers as members of boards and commissions. Reference may be made also to the fact that a number of engineers have become railway superintendents and have made good in the operating service.

A Lesson in Road Foundations

ONE of the boldest experiments in monolithic brick-road construction recorded during the few years of high popularity of that type of pavement was the completion in 1916 of a seven-mile brick road on a 1-in. gravel concrete base in Iroquois County, Ill. The construction of this road was described by Harlan H. Edwards in *Engineering Record*, Sept. 30, 1916, p. 400. At our request Mr. Edwards recently made a critical inspection of this road to discover its condition after nearly four years of service. His conclusions were given in our issue of June 17, p. 1207, with supporting records from an even less well remembered experiment in laying brick on a thin concrete base. The fact disclosed is truly remarkable. Not a single defect due to slab weakness exists. This result is explained by three words—a good foundation. In this particular instance the quality of foundation is due to a fortunate circumstance and not to planned construction, but its effect in preserving the stability of the pavement is not less important. Engineers probably should not, and certainly will not often repeat the construction described but they may well conform their practice constantly to the lesson of good foundation which experience with it has emphasized.

City Planning Pays

THAT city planning is a profitable investment, both to property owners and to the city, is a statement made in the recent report of the Chicago Plan Commission, which points out that the improvements resulting from its work have a direct financial return in increased property values besides stimulating the commerce, prosperity and welfare of the city. In support of its statement, the results of two recent projects now near completion are cited. The widening and extension of Michigan Ave. is estimated to have increased the value of property in the zone affected by about $35,000,000 and new buildings representing an aggregate value of $100,000,000 are under construction or projected. On 12th St. or Roosevelt Road the frontage value of land and buildings was $8,000,000 prior to the widening and extension, but although the improvement is not yet complete the value has increased to about $10,500,000. From the increased values due to these two improvements the city will receive an annual revenue of $3,575,000 if the taxes are assessed on the full increase in valuation. Property values and city revenues will continue to increase with the full development of these improvements. Similar results are expected to attend the various other improvements, the increased values extending through the adjacent districts and not being limited to the immediate vicinity. As the total expense for promoting the Chicago Plan has been about $400,000, the report seems to have good ground for its statement that the commission "is not a money spending, but a money earning institution."

Business Assists Utilities

ORGANIZED business men of Chicago in their appeals to the State Public Utility Commission for immediate action on pending rate adjustments, as noted in the news section of this issue, p. 1272, are setting an example which should be followed by similar bodies in other cities. Recently the more influential bankers of Chicago appeared before the commission and as a result of their efforts to make clear the critical situation of the public utilities business interests have begun thinking about rates in terms of service rather than politics. In the document signed by the officials representing 16,213 individuals and firms the needs of the community, the financial inability of the utilities to meet them, the serious and continuing menace to the commercial development of Chicago, the imminent danger of injury to private interests as well as to the public at large from lack of service were all pointed out. It is time business spoke with a united voice on such situations and it is encouraging to have so large a city as Chicago point the way.

An Endowed Hydraulic Laboratory

THE case for an endowed American hydraulic laboratory is presented on another page in the picturesque and forceful language characteristic of Clemens Herschel. The strong personal note in the article is justified by Mr. Herschel's own well known part in the development of applied hydraulics, which part, according to the article, has been hampered by the lack of adequate hydraulic laboratory facilities, available to all who could justify their claims of need.

The highest possible economic utilization of water becomes more important with every passing day. Scores of hydraulic questions press for answer. Our college hydraulic laboratories—considering their many limitations due to size, character of equipment and particularly the fact that their primary purpose is for use in instruction—do not fully meet the need. Practically all other hydraulic testing laboratories are connected with one or another commercial enterprise. Where, then, shall the hydraulic engineer turn?

Mr. Herschel's answer is that we should have an endowed hydraulic laboratory. From that few if any of our readers will dissent. Ways and means are the real questions for discussion. If sufficient funds were available to meet expenses it seems probable that the college laboratories, which are increasing in number and in the adequacy of their equipment, would be able to meet much of the need, so far as plant alone is concerned. This plant, for many of even the working-scale tests, need not be elaborate, nor are high heads or large volumes needed for all tests. Extraordinary facilities could be found or created at some colleges. Or they could be provided, as Mr. Herschel sees reason to hope will soon be done at Niagara Falls, in connection with private or public hydraulic works.

An endowment is the great and immediately pressing need. This would present administrative problems demanding most careful consideration to ensure fair opportunity to all deserving applicants for testing facilities, in the order of merit and promised public good.

Engineers and Railway Problem

IN the discussion and controversy over the railway situation, is not too much attention being concentrated on the rate question? It should be frankly recognized that freight rates are only one factor and that complete solution of the railway problem is not to be found in the settlement of the rate question alone. In other words, is not too narrow a view shown by those active in the consideration of the problem? Furthermore, do not other serious phases of the situation distinctly call for attention by the trained mind and broad vision of the engineer, in order finally to effect the results which are sought by those who have occupied themselves with consideration of the railroad problem as a whole? At times it has appeared that the railways failed fully to realize that the situation has its opportunities as well as its difficulties.

Attention is called to the abstract on p. 1260 presenting two views of the plan for relief by increasing freight rates. Improvement and extension of the railway system are necessary to keep pace with normal industrial development and require new capital and strengthened railroad credit. Presumably increased rates will be necessary to bring about this result, but it is suggested that higher rates may increase prices of commodities to such an extent as to decrease demand so that reduced volume of traffic may offset the effect of higher rates. This seems improbable, but the suggestion indicates the futility of relying on freight rates alone to serve as a solution.

In the present traffic tangle is there not evident opportunity for introducing more scientific methods of railroad operation? A marked increase in freight rates might have the result of checking, to some extent, the present cross hauling and indirect movement of freight, largely a result of competition for business between railroad companies. In the emergency the railways have been directed by the Interstate Commerce Commission to ship by the most direct routes, regardless of instructions of shippers, and there is reason to hope that the practice may be permanently retained. Such changes in operating methods offer opportunity of a cheaper handling of traffic, reduced mileage, and the liberation of cars for mainline service.

One of the fundamental policies of private railroad managements has been to "get business." Where followed blindly, this policy has resulted in delay and congestion of traffic, unnecessary haulage, and unfair competition. We have commented previously on the use of the interline embargo as a competitive measure. Under this system a company refuses to accept freight from another line while soliciting new business for its own line, over the same route. Obviously the result is to aggrevate rather than to relieve a bad situation. Much effort has been expended in obtaining business which produces cross hauls of like commodities and also in getting short-haul business which is handled by the railroads only at a loss, but which might be handled to advantage by interurban lines or motor transport.

Delay and congestion at yards and terminals, with-consequent slow movement of freight—a freight car averaging only about twenty miles per day—have been continuously troublesome for years past and constitute one of the great defects in railway operation. Recently the situation has become acute. Large quantities of new rolling stock will be delivered to the railroads by the builders in the next few months. Great sums of money are being spent on this equipment, but we do not find that any adequate provision is being made to afford the necessary additional line and terminal track facilities. Present congestion of terminals appears to call for the expenditure of at least as large a sum of money as will be required for the new mechanical equipment. When this development begins to take place there will be a decided need for the best engineering thought —a broader view of the problems at hand that will not be bound by time-worn precedent.

Are not the railways so alarmed over the financial situation and so intent on obtaining more income that they overlook their own shortcomings and their opportunities for the more economical use of present facilities and the possibility of more effectively extending them? Loyalty of the public to the railways has been urged, but loyalty of the railways to the public should first be demonstrated.

The need is apparent for a wider comprehension and a more constructive view of the situation, for which the engineer is peculiarly fitted by his experience and training. Times and conditions are still in a state of change and an unprejudiced viewpoint will be necessary in introducing new methods instead of trying to adapt old methods to new conditions. Here seems to be the opportunity for engineers and for the railways.

Has the Water-Power Bill Become Law?

IN spite of the fact that *Engineering News-Record* is definitely in favor of the Federal Water-Power Bill which was passed in the recent session of Congress, it has serious doubts of the validity of the signature which the President affixed to it some time before June 12, as announced by the White House on June 18. Possibly the bill has become good law, but before its provisions can be enforced the interpretations of the highest court will be required.

The whole issue hinges on an interpretation of the Constitution. In Section 7, paragraph 2, it is stated that "every bill which shall have passed the House of Representatives and the Senate shall before it becomes a law be presented to the President of the United States; if he approve, he shall sign it, but if not, he shall return it, with his objections, to that house in which it may have originated, who shall enter the objections at large on their journal, and proceed to reconsider it." After provision for passage by two-thirds vote over the veto, the clause continues: "If any bill shall not be returned by the President within ten days (Sundays excepted) after it shall have been presented to him, the same shall be a law in like manner as if he had signed it, unless the Congress by their adjournment prevents its return; in which case it shall not be a law."

With one possible exception the precedent during the 131 years of the existence of this government has been that a bill not formally acted upon in either way by the President at the adjournment of Congress automatically fails to become a law, provided the President did not have it in his possession over the ten-day limit. This precedent has been overruled by the opinion of the Attorney-General, on which the President acted.

On June 5 this year Congress adjourned without having heard from the President in regard to the Water-Power Bill which had been passed on May 29 and submitted to him June 1 or 2. The bill, therefore, by long precedent, was dead. However, nearly a week later, the White House announced that the Attorney-General had stated "that the adjournment did not deprive the President of the ten days allowed by the Constitution for the consideration of the measure, but only, in case of disapproval, of the opportunity to return the measure to the house in which it originated." This is an entirely new interpretation which on its face may appear valid, although it is somewhat tortuous. The difficulty to such an interpretation, however, is clearly indicated by the President's subsequent action on the bill.

The ten-day limit on the Water-Power Bill expired June 12. No notice of any action on the bill, however, came from the White House until June 18 when it was announced that the President had signed the bill "within the ten-day period, of course." Here is where the weakness of the Attorney-General's decision appears. If the President can wait one week before announcing the past signing of the bill, what is to prevent him waiting two months or two years? If the adjournment of Congress does not automatically kill all bills in the President's hands, what is to prevent the President from signing such bills within the ten-day limit, putting them away in a secret drawer to be brought forward as law when and if political strategy requires it? The signature of the President is a personal act and need be known to no one but himself. Certification of the signature as given by the Secretary of State is necessary to the recording of the law, but there is nothing in the Constitution requiring such certification within the ten-day limit.

In every other contingency but the one set up by the Attorney General's ruling, the fate of a bill is definitely known within ten days. During the session of Congress if the President would kill a bill he must return it to Congress before ten days elapse. If he fails to do so it is enacted automatically, whether he acts on it or not. The moment the ten days expire no subsequent announcement by anyone has any effect on a bill's status. By the new ruling, however, bills before the President in the ten-day period after adjournment have no definite term of life. An announcement of a refusal to sign has no constitutional standing, and on the other hand, at any time he chooses the President may announce his previous signature. As no provision is made in the Constitution for his active veto, because there is no Congress to which to return bills, the possibility of their being revived by a long slumbering signature always exists. In the week between June 12 and 18 the President had it in his power to tear up his signature and thus kill the Water-Power Bill. That week might have been extended indefinitely, with consequent Presidential leeway in approving bills clearly not indicated in the Constitution. Such a looseness in the process of law enactment is incomprehensible.

Engineering News-Record wants to see water-power development go forward. There never was a time when quick and decisive action was needed more imperatively. It therefore hopes that the constitutionality of the law's enactment will be decided at once so that all doubt of proceeding under it will be settled.

Precast Concrete Roof Trusses in Panama Pier Shed

Discussion of the Feasibility of Concrete Roof Trusses with Comparisons of Cost Data Between Two Similar Sheds, One with Reinforced-Concrete Roof Trusses and One of Structural Steel

By Guy W. True
Engineering Designer, the Panama Canal

REINFORCED concrete was substituted for steel in the construction of the pier shed for Pier 6, the latest of the shipping piers at Cristobal, C. Z., with a consequent saving in cost and an assurance of completion at a time when steel deliveries were uncertain and the cost of steel high. Precast concrete trusses were used for the roof with marked success and economy. Although unusual conditions led to the adoption of this type of structure, the results have been so satisfactory as to make worth while an analysis of the condition of design and a comparison with the usual steel structure as a guide for future work. A detailed description of the sub-structure of this pier, which is also of a novel type of reinforced-concrete design, appeared in *Engineering News-Record*, Nov. 27–Dec. 4, 1919, p. 912.

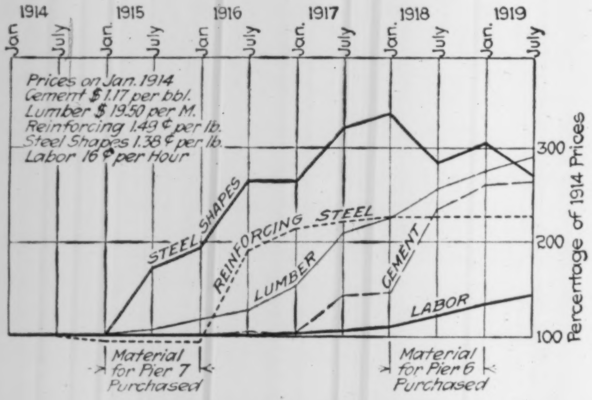


FIG. 1. PERCENTAGE INCREASE IN PRICES ON ISTHMUS OF PANAMA, 1914-1919

Innovations in roof framing design, particularly for long spans, are constantly being put forth by designers. Wood, of course, has been largely superseded by structural steel, due not only to advantages accruing from the higher allowable unit stresses but the comparatively decreased fire hazard. When properly maintained, steel has undoubtedly a greater durability than wood, but as most structures have outlived their usefulness long before the material has begun to deteriorate it can hardly be offered as a valid criticism.

The progress of reinforced concrete as a roof material has been considerably retarded by the inherent dead weight of the concrete. This objection particularly applies to long span construction (of 30 ft. or more) where the major part of the stress in the concrete beams is due to the dead weight of the concrete itself. This factor has necessarily limited its economical use, and thus we find that concrete has been used as a roof framing material in preference to steel in such instances, only when other considerations than cost governed.

Sometimes it is desirable to incase steel roof girders with concrete as a protection against fire. The cost of this extremely conservative type of construction naturally excludes it from any except the occasional design.

Of late the costs of both labor and all engineering materials have undergone increases far greater than most engineers ever anticipated. If all items advanced proportionately these price changes would have little effect upon design except possibly a more exact calculation of stresses. The important fact, however, to be noted in reviewing these price changes is that the rates of the present prices of each material to its value before the war is different for each item. Fig. 1 gives the ratio of costs of steel, cement, lumber and labor on the isthmus to costs in 1914. As transportation to the isthmus is included in all items, they may not be exactly the same as similar quotations in the United States. The chart shows that these ratios have a wide range.

It will be noted that structural steel shapes have the greatest variation and labor the least. From the relatively slight increase in labor costs, it might be inferred that complicated structures requiring more than the usual amount of field construction could be specified to advantage.

The chart further emphasizes the fact that an economical solution of a problem in design might be totally different if made under conditions in 1918 than if made in 1914. Those familiar with European cost data during the decade prior to the war, can readily see that prices in America have now approximately approached the ratios that then existed in Europe. Obviously, economical requirements demand more exact analyses leading to what might ordinarily be considered bold designs. As Europe has numerous examples of such structures it may naturally be expected that these types of design will come into more common use in this country, provided, of course, that the present ratio of prices continue.

DETAILS OF DESIGN OF PIER 6

The shed of Pier 6 is 945 ft. in length, 159 ft. in width and has a clearance under trusses of 25 ft. The layout of the design is simple, columns being spaced 39¾ ft. transversely and 45 ft. longitudinally. The longitudinal trusses are 45 ft. in length, 4 ft. deep and are spaced approximately 10 ft. on centers. Each truss is composed of 3½ cu.yd. of concrete, contains 1,000 lb. of reinforcing steel and weighs about 8 tons. These trusses are supported by the cross truss which carry the load directly to the columns.

The cross trusses are about 39 ft. in length, 7 ft. deep, and extend from column to column. Each one contains 8½ cu.yd. of concrete, 4,000 lb. of reinforced steel and weighs 19 tons. As these trusses were sloped ½ in. per foot to conform to the pitch of the roof, level notches were required in the top chord as a support for the seats of the longitudinals.

The design of the longitudinal trusses which support the inner crane rail is a modified form of the standard truss. It is slightly deeper, and has accordingly a correspondingly greater resisting moment sufficient to carry the wheel loads of the crane. The crane rail is securely bolted to the top chord, as some positions of the load on the crane develop an uplift on the inner rail. Naturally, the truss is designed to withstand this negative moment. The crane was designed to withstand a load of 11,000 lb. in the cable passing through the suspended blocks.

The entire pier is covered with a roof slab of 3½ in. thickness. This thin slab might well have been made thicker to minimize deflection and consequent reduction of tension cracks with increased water-tightness. However, as any increased weight of the slab affected the design of the trusses materially, preference was given to the thin slab, a waterproofed covering, of course, being required.

As the possibility of any very heavy live-loads being placed on the roof was very remote, a live-load of only 10 lb. per square foot was used in design. It should be remembered, in comparing this designing load with specifications in the United States, that no wind, snow or ice load need be taken care of in roof design in this locality. As a matter of fact this live-load has been used in roof design of numerous other Canal structures with success. The consequent ratio of live to dead loads used in truss design is therefore about one-eighth. This means that each of the 315 longitudinal trusses is carrying about eight-ninths of the full design load due to dead weight alone. The cross trusses have, of course, an even greater proportion than this.

Various kinds of trusses were fully investigated before a decision was reached as to the most suitable type. Among these were bow string trusses (lower curved chord), the Vierendeel truss in which no diagonal members are used, and, finally, the Visintini truss which was subsequently recommended. The Visintini truss, when diagonals are used in all panels, is of practically the same form as the Pratt truss used in this country.

The slope of the diagonals was fixed at 60 deg. and no verticals used so that it closely resembles a Warren truss. This particular type of design had comparatively simple form work as compared with the others and offered no objections to development of satisfactory end connections and various other details.

The investigation of primary stresses were made under the assumption that it was a simple structure; that is, hinged at the joints. It would appear off-hand that the large size of cross-section of members as compared with their respective lengths would cause introduction of secondary stresses through distortion. These were accordingly investigated under the assumption that the increase in lengths of tension members was solely a function of the stress in the steel.

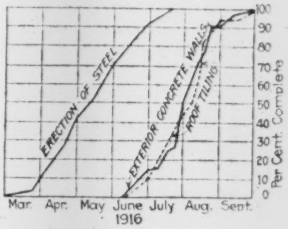


FIG. 3. PROGRESS CHART OF ERECTION—SHED OF PIER 7

As the incasing concrete of these members reduces the elongation an appreciable amount, it is evident that this assumption was on the safe side. Calculations (made for full load) showed that the maximum fiber stress in the concrete due to such secondary stresses was approximately 300 lb. per square inch. In a tension member this figure is of course meaningless, as the steel not the concrete is carrying stress there. In compression members, however, it is additive to the primary compressive stresses. As 750 lb. per square inch is permissible in certain parts of design it was considered reasonable to allow this figure decreased by 250 lb. per square inch; that is, 500 lb. per square inch as a maximum compressive stress in the concrete neglecting the effect of secondary stresses. The exact theory and path of stress at the joints is in reality not known to any great degree of certainty and sufficient stirrups were placed there to tie the mass of the concrete together and take care of these unknown factors as much as possible.

Erection stresses were small when calculations were made assuming the support as suspended from the erecting crane, but other stresses in handling, such as raising the truss from a horizontal to a vertical position, could not well be calculated and the compression steel and stirrups shown in columns were counted upon to resist this effect. Particular care was demanded in the erection to minimize these unknown stresses.

Of the general proportions of the trusses little need be said as the ratio of depth to span is not widely different from ordinary design. The width of the top chord is in reality small when compared with the span length. During erection great care was necessary not to handle the trusses on their side because of this feature, but after the structure was completed lateral deflection was not possible as the chords were well supported by the roof slab or other trusses.

In figuring the bending stresses in the top chords due to uniform load, the floor slab was neglected, but it of course assists that member in bending to no small extent, because of the bond developed between them.

Marked advantages would be obtained if all trusses could be made continuous and preliminary designs were made with this as an objective. As the various trusses

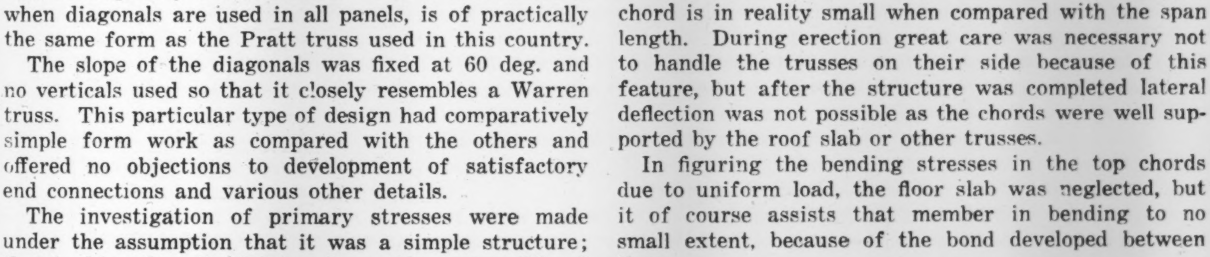


FIG. 2. PIERS 6, 7 AND 8, IN ORDER FROM LEFT TO RIGHT, CRISTOBAL. CANAL ZONE

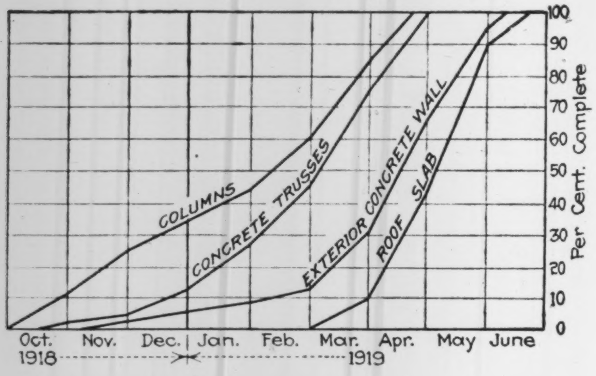


FIG. 4. PROGRESS CHART OF ERECTION OF REINFORCED-CONCRETE SHED OF PIER 6

were built separately and later placed in their final position, a joint over the top of the supports was required to secure continuity. The difficulty of obtaining an adequate joint for this purpose was the main cause of the rejection of this type of design. Care was taken in the accepted design to avoid any condition of restraint at the ends, and, hence, the actual stresses are undoubtedly close to calculated ones. As the roof slab is poured continuously over the tops of longitudinal trusses probably some small restraint is caused from this condition, but the play betwen the ends of the lower chords tends to offset this disadvantage and the resulting stresses may accordingly be neglected.

Deflections of the trusses are negligible, as they are less than would be the case if a beam of similar resisting moment was substituted. No cracks other than shrinkage cracks could be discovered.

The supports of a comparatively new type of construction should be as rigid and non-elastic as possible, so the columns were made much heavier than would ordinarily have been required. Also the possibility of adding an additional intermediate floor was allowed for.

Because of the requirement of lateral stability in addition to adequate bearing at the supports of the cross trusses, recesses of sufficient size were furnished in the upper portions of the columns. Although the resulting shape of column does not readily lend itself to construction of formwork its importance justified the particular detail adopted. The width of the cross-section of column at this detail was a factor that largely determined the size of the main body of the column in order to obtain reasonable proportions.

The unusual features and unknown factors such as erection stresses, joints, etc., entering into the truss design justified a test. Accordingly, one of the cross trusses was loaded with an equivalent of the full dead and twice the live load. The test was successful, as no noticeable cracks were developed in the course of the application of the load.

METHOD OF CONSTRUCTION

Due to lack of uniformity in the cross-section of the columns it was deemed advisable to pour them in three stages—base, main section and top. The enlarged base firmly anchored to the substructure with reinforcing resulted in a column of considerable stability, a feature of no small importance in supporting precast trusses.

The construction of the trusses themselves was naturally divided into two main parts, first their manufacture and later their erection. Forms for the triangular spaces between the web members were built of 2 x 4-in. material covered with 1-in. sheathing. A keyed joint was inserted to facilitate removal.

These forms were then laid flat on the level concrete floor of the pier, properly spaced, and after the outside portions were placed in the correct positions, the form was ready for the reinforcing. Four complete sets of forms were provided for the cross trusses and twelve sets for the longitudinals. Each form for the longitudinal trusses was accordingly used about thirty times. As they were strongly constructed, very little repairing was required, and hence the number of times that these forms were used effected a great economy in the unit cost of form work.

It was found that the reinforcing could be advantageously assembled and wired together before placing it in the forms. This process was accordingly followed, thereby enabling the reinforcing gangs to proceed independently of the group engaging in construction of

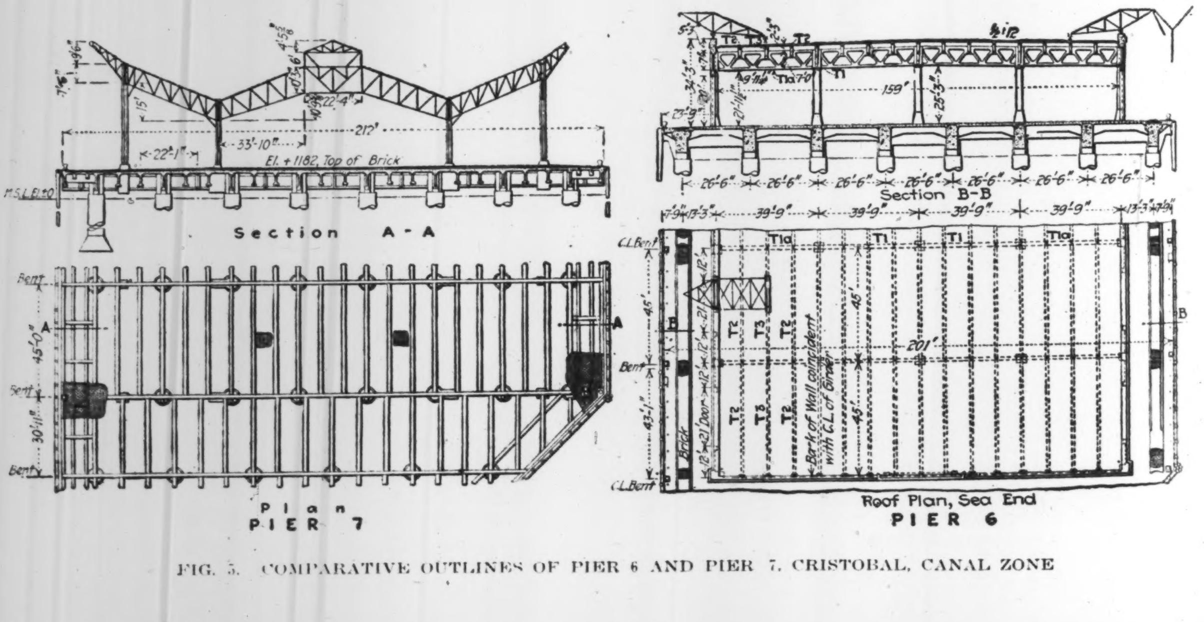


FIG. 5. COMPARATIVE OUTLINES OF PIER 6 AND PIER 7, CRISTOBAL, CANAL ZONE

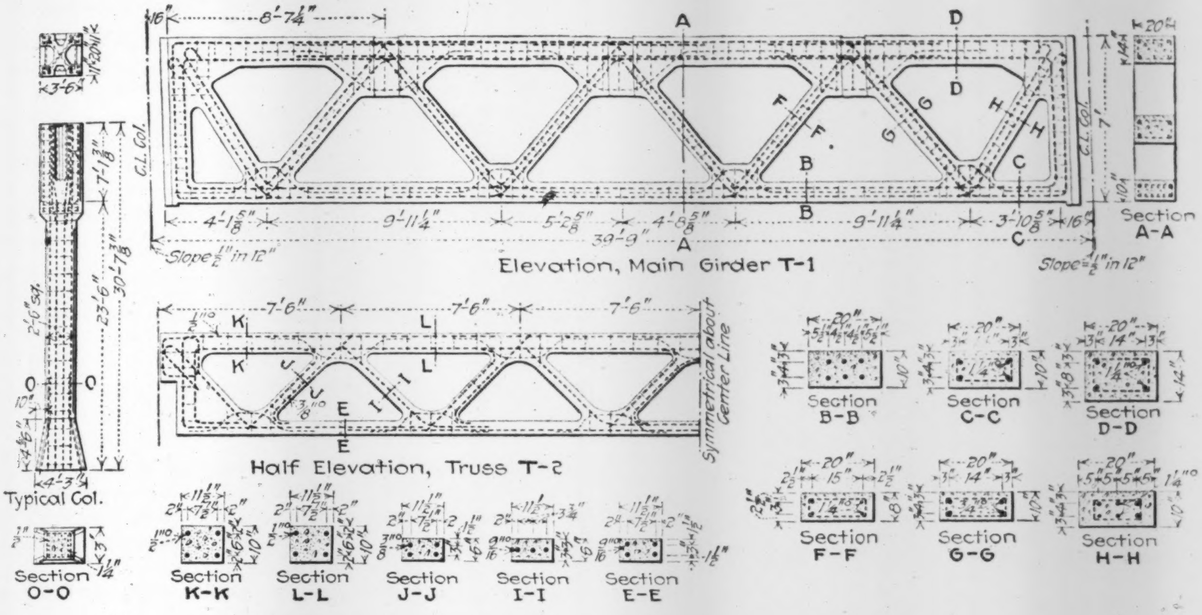


FIG. 6. DETAILS OF CONCRETE MEMBERS IN SHED OF PIER 6

forms. Furthermore, the placing of the assembled reinforcing by a locomotive crane materially increased the speed of manufacture.

After the concrete had been poured the forms were left on twenty-four hours and then removed, care being taken not to disturb the fresh concrete. Instead of complete removal, however, they were simply raised to an elevated position so that the lower part of the form was flush with the top of the completed concrete. Reinforcing was then placed and a new truss poured directly over the old one, the two pours being separated by a layer of paper. By such a system it was possible to pour several, one above the other, thus saving a great deal of valuable floor space and, incidentally, enabling construction to proceed continuously. As many as four trusses were built in each pile in this manner, the height of pile being limited only by the elevation of the concrete chute from the mixer. The spaces between the web member were then filled with water, so that it was only necessary to wet the outside portions of the trusses from time to time. Keeping the concrete moist while setting was especially important, as evaporation takes place rapidly in this climate.

All concrete was allowed to set at least thirty days before erection was permitted. The primary operation in erection was to bring the truss from the horizontal to a vertical position, then to raise it by means of locomotive cranes to its final location in the roof.

The cross trusses were erected first. Two 25-ton locomotive cranes were used, one at each end of the truss. Grout was placed in the seats of the recesses in columns so that good bearing was obtained for truss supports. More than usual care was demanded of crane operators as both ends of truss had to be kept at approximately the same elevation during erection to avoid unnecessary strains in the concrete.

In erecting the longitudinal trusses only one 25-ton crane was required. An 18-in. 92-lb. Bethlehem steel girder beam was bolted to the top chord and the hoisting tackle was fastened to the middle portion. After properly balancing, the entire arrangement was elevated to its final position where the steel girder beam was released for further use.

This method of erection was successful throughout construction, and fortunately, no accidents occurred during the course of the work.

It can hardly be expected that concrete construction will ever be as rapid as structural steel, as most of the labor in steel work is done in the fabricating plant. In viewing the progress chart, Fig. 4, it should be borne in mind that in the earlier stages of erection a portion of the field forces were engaged in the completion of the floor system, so that the later months gives a more accurate measure of the rate of progress of this class of work. From this it would seem that these unit built trusses are fully as rapid a form of construction as concrete poured in place and might possibly compete with steel for rapidity in erection.

The actual field organization that completed the above work was composed of negro labor, supervised by four white foremen, one to each gang. Twenty-two laborers were engaged on form work, twenty-two on mixing and pouring concrete, four on reinforcing, and sixteen in erection. It is very probable that speed in construction could have been further increased with an additional amount of labor and equipment.

Following the erection of the trusses the walls between the outside columns were poured in place. These walls were 6 in. thick and reinforced by ½-in. diameter rods 24 in. on centers. Finally, the construction of roof slab completed the concrete work.

For comparison of progress of the entire work with that of a similar shed of structural steel and roofed with tiling, the progress chart of Pier 7 is given in Fig. 3.

As a substitute for continuous steel framework built on Pier 7, eight movable overhanging cranes were used, running on tracks of 20 ft. 4 in. gage placed upon the roof. These structures were not operated as cranes in the usual sense as they have no motive power to move

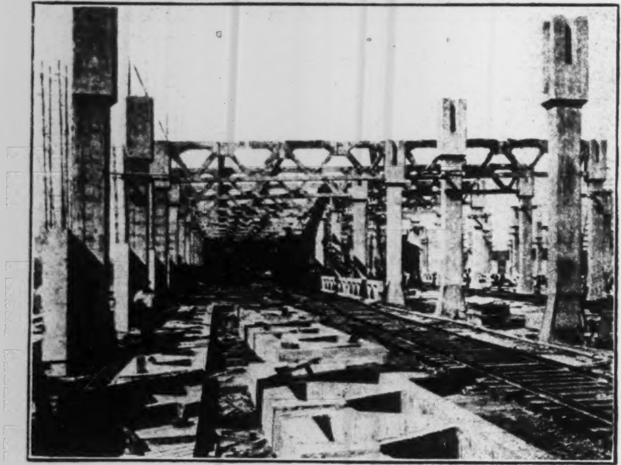


FIG. 7. COLUMNS IN PLACE FOR REINFORCED-CONCRETE TRUSSES

themselves along the track or lift a load. The apex of the crane is simply a point of support for block and tackle to be operated by a winch motor on the floor of the pier in addition to hoisting devices usually furnished by steamships. The crane is easily moved along the track by hand to the position desired.

Openings for doors were 21 ft. wide and 20 ft. high. An approved type of rolling lift door was used, as it gave entire satisfaction in prior shed construction. In resorting to this form of door a maximum amount of floor space is available for storage.

In lieu of a monitor framework for lighting in the central portion of the shed, two rows of 210 skylights were placed in openings 12 x 22 in. left in the concrete slab. No leakage resulted from this form of construction.

Sufficient electrical equipment was installed to secure ample light and power for operating the winch motors. Two units each consisting of one lighting transformer, one power transformer and switchboard were inclosed in concrete compartments with proper provisions for ventilation.

An outlet was furnished at alternate outside columns for operation of the 22-hp. portable winch motors, four motors being sufficient for unloading purposes on the entire pier. The shed is also equipped with eight soundproof telephone booths each of which contain a lighting distribution panel and a fire alarm box. Eighty-four lamps, each of 500 watts with porcelain enameled steel reflectors furnish ample light. To facilitate the cargo handling to and from ships at night additional lamps with angle type reflectors and cast-iron protectors are located on outside of shed walls at the upper portion of columns. Nine outlets in floor at the edge of dock, are supplied for ships telephones, service and emergency lighting. The power system is operated by 220 volts a.c., and the lighting system by 110-220 volts a.c.

The remarkable saving effected by the use of these concrete trusses as a substitute for steel is emphasized by the cost data presented in Tables I and II. The fact that a steel pier shed costing $387,483 in 1916 was duplicated in the face of an unprecedented rise in material costs, in concrete for $360,010 in 1919, deserves especial comment. An itemized analysis shows that although the unit cost of each item increased, the total costs were unmistakably in favor of the concrete trusses. A rough calculation indicates that had the shed of Pier 6 been executed in structural steel it would have cost at least $560,000. It is therefore evident that the employment of the concrete trusses effected a saving of approximately $200,000 or over one-third of the anticipated cost of the project.

TABLE I.—COST OF SHED OF PIER 6.

	Cu. Yds.	Unit Cost	Total C
Columns	764	34 14	$ 26,082
Trusses	1852.	43 38	80,356
Erection of Trusses	1852.	4 04	7,500
Walls	1801	45 56	82,123
Roof Slab	1623.	32 86	53,720
Miscellaneous	.....	.....	110,226
Total	.....	.....	$360,010

TABLE II.—COST OF SHED OF PIER 7.

	Unit	Unit Cost	Total Co
Steel (Erected)	1993 Tons	81 21	$161,857
Concrete Wall	2347 Cu. yds.	22 96	53,879
Roof Tiling	1705 Squares	26 00	44,337
Miscellaneous	....	.....	127,409
Total	....	.....	$387 483

The unit costs of forms, reinforcing and concrete for columns, trusses, walls and roof slab are presented in Table III. These figures conclusively show that concrete trusses can easily compete with the usual monolithic concrete construction for each item given. It is possible, however, that the trusses would not show up to such an advantage if comparisons were made on a smaller sized project, as much of the saving results from the efficient use of the removable forms

TABLE III.—PIER 6. UNIT COSTS IN DOLLARS.

	Forms (per sq. ft.)	Reinforcing in place (per pound)	Concrete (per cu. yd.)	Erection (per cu. yd.)
Columns	.205	.068	13.26	...
Trusses	.134	.047	11.12	4.04
Walls	.343	.056	16.81	....
Roof Slab	.150	.063	15.57	...

The forms for the trusses cost only $13,918, while the cost of reinforcing was $45,831, and the concrete $20,607, making a total of $80,356. Each longitudinal truss cost about $166, while the cross trusses cost about $400 a piece. On a cost basis alone the above figures indicate that for unit built construction work, carrying light superimposed loads, reinforced-concrete trusses have a wide field for development in the future.

DISCUSSION OF THE DESIGN

There are some general comments on this design which have applicability to future work:

Generally speaking, material is used more efficiently in trusses than in beams, particularly when moment rather than shear is the governing factor. In a reinforced-concrete truss, however, the fact that the compression members should have a slight amount of compression steel to provide for unknown stresses, and that the concrete in the tension members cannot be counted upon to carry any tension, together with complicated formwork and erection, it is not evident at first sight that this type of construction will prove to be economical in the end.

Probably the best basis for comparative cost data would be an analysis of costs of two projects built at the same time, one of structural steel and the other of reinforced-concrete roof trusses. A comparison approximating these conditions is furnished by two recently constructed pier sheds on the Canal Zone. The shed of Pier 7 covering an area of 154,000 sq.ft. was built in 1916 of structural steel roof trusses, while the shed of Pier 6, covering 150,000 sq.ft., was constructed with concrete roof trusses in 1919. Since both sheds had practically the same requirements in design the costs of the two projects should be illuminating to those interested in concrete trusses as a type of roofing construction. Before describing the design and construction of Pier 6 shed, a few points relative to concrete trusses will be outlined thus enabling a better understanding of the detailed description which follows:

When concrete trusses are employed instead of beams, obviously it is not practicable to attempt to pour them in place. It is advisable to pour the trusses on their sides and later erect them in the proper position. It is interesting to note that in the truss the cost of the poured concrete alone (exclusive of reinforcing) plus the cost of erection is practically the same as the unit cost of concrete in beams poured in place. Since the unit cost of this item is the same in both forms of construction evidently a slightly economy is effected by the use of trusses as the material is used to greater advantage. This saving, however, is partially offset by the fact that the trusses are calculated as simple structures while the beams are usually figured as being continuous.

The similarity of panels in the trusses is well adapted to use of strong collapsible forms capable of withstanding rough usage, and being used many times with a resulting reduction in cost. On the other hand, although forms for ordinary beams and girders can be used more than once, a large percentage of the timber is lost through wear and tear at each operation, consequently the lumber may last but a relatively short time.

Although the depth of concrete trusses is usually greater for good proportions than an equivalent beam, the amount of reinforcing in the compression members to take care of secondary and erection stresses makes the amount of reinforcing in either design practically the same. The ease with which the reinforcing is placed in the truss while laying on its side is a slight advantage tending to lower unit costs of this item.

Of special interest is comparisons with steel construction. In roof trusses, particularly where the superimposed loads are low, the allowable unit stresses in steel are often small because of the large ratio of length to radius of gyration. In the tension members the total stresses are often so low that even minimum sized sections will have small unit stresses. Were it not for their extreme flexibility rods could be substituted in such cases. Thus it is apparent that although the nominally unit stress in light steel construction is 16,000 lb. per square inch, the actual unit stress is often far less than this. The proportional waste from these factors is much greater in the light construction than in heavier work.

If proper equipment is available and reasonable care is taken, the erection of the concrete trusses should not offer any greater difficulties than steel. As no field riveting is required in erection the cost of this item is eliminated. Since many variables enter into cost of erection, specific comparative cost data between steel and concrete is hard to obtain. The actual cost per cubic yard of erecting the concrete trusses of Pier 6 is given later under cost of construction.

Especial emphasis should be placed upon the low maintenance costs of the concrete trusses as compared with steel, particularly in a locality where corrosion takes place rapidly if the steel is not properly protected. In permanent structures, maintenance costs are of no slight importance. Painting is only a temporary expedient and must be continued throughout the entire life of the structure. It is a matter of common practice in many important permanent constructions to incase steel girders in concrete as a protective measure only. This method has been followed by the Panama Canal in construction of floor systems for piers. The cost of incasing the steel girders in the floor system of Pier 7 was $81,000, this amount being about one-third of the cost of the steel itself. The fact that engineers consider it wise to incur large expenses in initial costs for protective purposes only should therefore receive consideration when comparisons between steel and concrete are made.

The value of goods stored in a structure require a proportionate safeguard against fire, although steel is in no sense inflammable, its rapid loss of strength when subjected to any considerable degree of heat places it in the class of structures that are not considered fireproof. In a strict sense, of course, no material is absolutely fireproof. The low heat conductivity of concrete, however, has caused it to be recommended by underwriters as a fireproofing material. From this

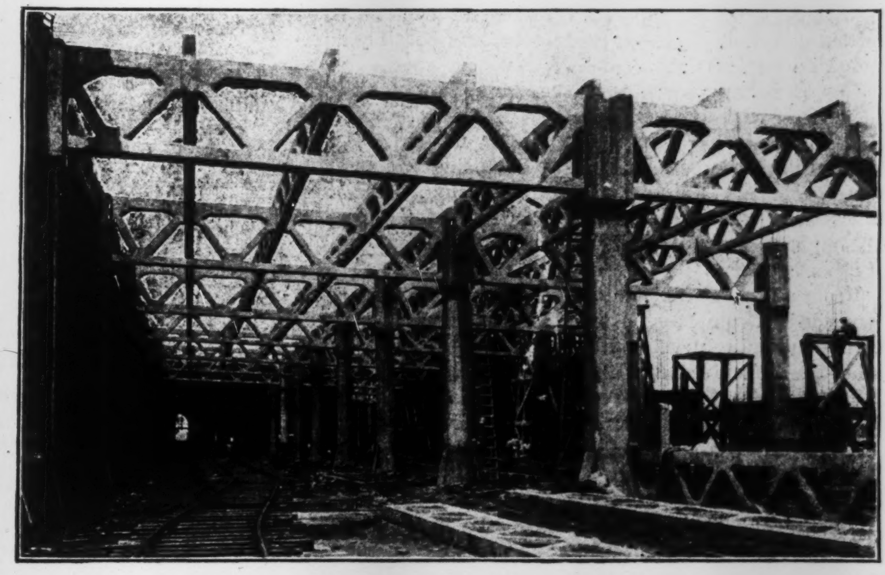


FIG. 8. PRECAST CONCRETE ROOF TRUSSES ERECTED

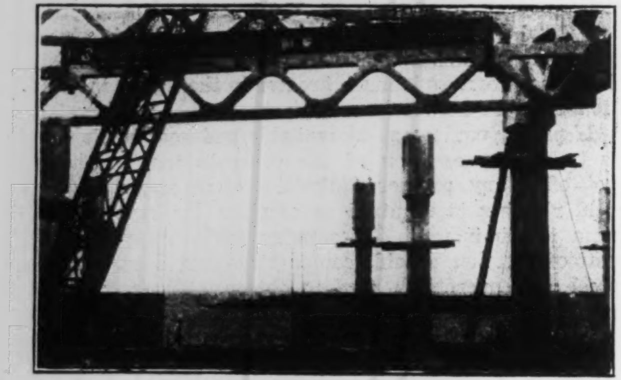


FIG. 9. SWINGING PRECAST CONCRETE TRUSS INTO PLACE

standpoint concrete has a great advantage over steel in the shed construction of piers, where large amounts of goods are stored, usually of considerable value and often of inflammatory character.

A comparison of weights of similar constructions is not of prime importance but may be worth noting as it affects foundation requirements to some degree. The weight of the structural steel trusses, purlins, columns, and lateral bracing was 26 lb. per square foot on Pier 7, while the weight of the corresponding construction, that is, columns and concrete trusses on Pier 6 was 69 lb. per square foot. No great significance is attached to the weight of walls or roof covering, hence they were not included in the above figures. It would naturally be expected that the concrete would be heavier than the steel and although this may be considered a disadvantage it applies with equal force to concrete beams as well.

The radical change from a girder of reinforced concrete to a truss of the same material deserves comment as certain questions arise in the design of the latter that may well be the subject of future investigations. The theory of stresses in the rigid joints, the amount of steel necessary in compression members, the action of the concrete in the tension members and other details of connections are all questions that can only be settled definitely by tests, experience, and possibly additional theoretical data.

Our present knowledge of concrete, however, when combined with conservative assumptions regarding these questionable points is sufficient for safe design. The tension members can hardly be considered as reinforced concrete is conceived of in the usual sense. The concrete is merely a protective coating for the steel although it transmits the stresses from one rod to another by bond.

From a theoretical point of view no compression steel is needed in compression members, but a small amount is undoubtedly justifiable to take care of erection or other possible stresses incident to such construction.

The distribution of stress at the joints is a matter of more or less conjecture. As the practice in steel riveted joints is to make such a detail stronger than the net section of members this practice would naturally be followed in concrete truss design. If sections are taken through various joints it will be found that the shearing stress on the concrete is higher than is ordinarily allowed in usual concrete design, but since the steel rods are carrying the stress from one tension member to another in such instances, it may be considered permissible to ignore the high unit shear and depend entirely upon the steel to take the load. Although stirrups have little value in assisting the concrete in punching shear at the joints they may well be added as a factor of safety.

Recommended Grade Elevation at Galveston

IN accordance with an item in the 1917 Rivers and Harbors Act, the Secretary of War has just transmitted to the House of Representatives a report of a board of engineers from the United States Engineer Department on the further protection of the city of Galveston, Tex., and Galveston Island. The history of the ocean protection work at Galveston is well known to engineers. The latest description appeared in *Engineering News-Record*, Sept. 15, 1919, p. 617. The protecting works consist, in brief, of a sea wall extending practically along the entire south or ocean front of the island, with the exception of a distance of 2,860 ft. at the extreme east end of the island between the end of the 10,300-ft. extension now under way and the south jetty. This sea wall has a top elevation of 17 ft., which is about 3 ft. above the highest water level observed in Galveston at any of the numerous tidal floods. In the original Robert report it was intended to raise the entire level of the city by filling to a grade of 8 ft. at the bay side of the island and rising approximately 1 ft. in 1,500 to the 17-ft. elevation of the sea wall.

The early Robert report further recommended a north and south levee across the island at the western boundary of the city, but neither the levee nor the complete filling behind the sea wall was ever placed. Following the 1909 floor the embankment behind the sea wall was raised so that there was a ridge elevation of + 21 near the south or ocean side, but no extensive grade elevation was carried on on the bay side. It is the opinion of the latest board that the whole grade of the city of Galveston must be raised to an elevation of 14½ ft. if the safety of the city is to be insured. This is estimated to cost $9,500,000, of which about $6,000,000 would be city expenditure and the rest private expenditure. The board further recommends that the dislodged riprap at the sea wall be replaced, that the ridge parapet wall on the south side of the island be changed and strengthened somewhat, that the sea wall be extended the final 2,860 ft. to the south jetty. This sea wall extension, it is proposed, would be done by the Federal Government.

The board composed of Brig.-Gen. Herbert Deakyne, Colonel Spencer Cosby and Colonel T. S. Reinecke, U. S. A., with R. L. Vaughan, of San Francisco, as special consulting engineer. The report is published in document No. 693, House of Rrepresentatives, Sixty-sixth Congress, Second Session.

Some Municipal Departures

Group insurance for all municipal employees, from city judge to garbage collector, has been established by the city of Albuquerque, N. M., according to *Notes*, the the weekly publication of the Municipal Reference Library of New York City. The same publication is authority for the statement that the City Council of Johannesburg, South Africa, has voted to establish a municipal foundry at an estimated cost of about $5,000.

The Need for an Endowed American Hydraulic Laboratory

*As Shown by **Clemens Herschel**, Consulting Engineer, New York City, in His St. Louis Weir-Test **Paper** and In an Interview with a Representative of Engineering News-Record.*

THROUGHOUT the paper on "An Improved Form of Weir for Gaging in Open Channels," presented by Clemens Herschel at the St. Louis meeting of the American Society of Mechanical Engineers in May, 1920, illustrations were given of the need for better hydraulic testing facilities and arguments were presented for a great hydraulic laboratory—or "observatory," as Mr. Herschel prefers to say. The part of the paper dealing specifically with the weir tests was given almost in full in *Engineering News-Record*, April 8, p. 710. There follow here Mr. Herschel's statements bearing on the need for a great hydraulic laboratory, both as made in his St. Louis paper and to a member of the editorial staff of this journal.

FRANCIS EXPERIMENTS AT LOWELL

In opening his paper Mr. Herschel first takes up some historical aspects of the subject, which bring out the great part played by J. B. Francis in practical hydraulics. He then urges that "the only standard water-gaging apparatus is a tank or reservoir." The four paragraphs on these topics are as follows:

To any one whose memory of hydraulic engineering in the United States, more especially in New England, runs back sixty, or even fifty, years, the standing at that time of the "Francis formula" for weir discharge will appear as little short of infallibility, or of perfection. Courts of justice recognized it as decisive; lawyers of eminence played with it as though it were one of the choicest morsels from the tree of knowledge; it was the last word in gaging the flow of water. And there was reason for such an estimate of its value at the time.

James Bicheno Francis was then easily the leading hydraulic engineer in the United States, with perhaps not over half a dozen of the species in the whole country. Grappling as a young man with the problem of insuring their lawful quantities, day by day, to each of the seven "Proprietors of the Locks and Canals on Merrimack River," at Lowell, Mass., out of the common trough or canals which fed them collectively, he may be said to have been the first one who thus brought order out of the disorder which that communistic distribution of water—naturally accompanying the American system of power distribution canals for manufacturing purposes, and now passing away in favor of the electrical distribution of power—always brings with it. For the purpose named he instituted, about 1850, the series of hydraulic experiments described in his book entitled, Lowell Hydraulic Experiments; and he did this with all the accuracy obtainable at the time and place that has been named.

LOWELL EXPERIMENTS ON NATURAL SCALE

From another point of view than just described were his experiments of a new order of importance. If any one will consult Weisbach's "Experimental Hydraulik," or the later editions (1855-60), of Weisbach's "Mechanics," he will be surprised at the Lilliputian dimensions of the apparatus then in vogue as the basis of engineering knowledge for use in the practice of hydraulics. Thus, Weisbach's experimental reservoir had an area of 1.35 sq.ft.; and his ajutages were ordinarily about 0.03 ft. in width, or diameter. Of course, we know that Atwood's machine, of extremely moderate dimensions, will measure the force of gravity exercised by the globe which we inhabit; but it requires more confidence in the "horse sense," no less than the technical ability, of hydraulic engineers than is possessed by the average mill owner or his agent to give him confidence in the work of the engineer he employs, should that engineer base it on experiments such as inspired Julius Weisbach or his immediate disciples. So that the experiments of Francis, conducted out of doors on a scale commensurate with their importance, at the Lower Locks near the Concord River, came to the interested "Proprietors" and others as a refreshing and new conquest of mind over matter. They were much more reliable because made on a natural scale; exact, as every one could appreciate, from the care taken in making the experiments and the computations following the experiments, and thoroughly reliable.

At that time arose the expression, "made with a standard weir," which has remained alive to the present day, although, as will presently be seen, there was no propriety whatever for calling any weir a "standard." The only standard water-gaging apparatus is a tank or reservoir. Weirs, orifices, venturi tubes and meters and other water-gaging apparatus and methods can become truly rated only by comparison with tank measurements, and thus thereafter competent to give reliable service. Such comparisons, moreover, establish the *degree* of reliability of the several methods that have been subjected to comparison, and from this point of view the weir has for many years been falling into deserved disrepute.

Elsewhere in his paper, Mr. Herschel says that "it is not often, as yet, that one can get a reservoir of sufficient capacity to supply 46 cu.ft. per second for the period of a hydraulic experiment; and, in the opinion of the writer, the venturi meter is the next best thing." Mr. Herschel then introduces some testimony as to the accuracy of the meter named and follows it by comments on "the imperfections of human abilities"—or variations due to the personal equation, as follows:

That the venturi meter is of a high order of accuracy has been shown by a compilation by the writer for the Power Test Code Committee of all attainable relevant experiments made with it during its existence of thirty-odd years. A very significant series of tests, made by F. H. Shaw, of a meter at Lancaster, Pa., show an average variation of 0.036 per cent for 41 tests, covering a period of eight years.

VARIATIONS DUE TO HUMAN IMPERFECTIONS

The variations of this record illustrate the imperfections of human abilities rather than those of the meter. The meter, with its bronze-lined throat, surely did not vary in its action, as the 8-year record indicates; nor did the laws of nature, as manifested in the science of hydraulics. Nor can the city water-supply reservoir that was used as a tank be supposed to have varied in capacity.

What, then, did vary? Plainly the accuracy of the human element brought into play.

In another place the present writer has compared the case with the familiar results found on repeatedly measuring, say, with a tape line, a base line. Nothing is simpler in execution, yet, as every engineer knows, no two measurements are ever precisely alike except by accident. The end points have not moved; the steel tape has been compensated each time for stretch and temperature; and yet we take an average of measurements to represent the true distance apart of the end points. It may be argued that the percentages of variance in the two cases are different, and smaller in the case of linear measurements; but, on the other hand, feet are easier to measure than cubic feet per second. The one deals with a simple dimension, the other with four.

At another point, after stating that he forecast the new weir of 1919 by an outline published in 1898, Mr. Herschel illustrates from his own experience the long existing need for a hydraulic laboratory, and cites with feeling a denial of a request he made for aid, the denial being due to the fact that certain funds were available for researches in "pure science" only, thus:

> More particularly was it forecast in the *Transactions* of the American Society of Civil Engineers discussion of 1918 that has been named. So here was a case of an invention, or vision, if one pleases, in practical hydraulics, that had to wait twenty years in the brain of the engineer, for lack of public or private facilities to test it. An attempt to experiment, as has now been done, was made some ten years ago, but was frustrated by the writer being informed by the manager of a richly endowed institution that its funds were available only for research in sciences that had no practical applications. The wonder is that any progress at all is made in this most useful of the arts; treated by the general public, as was Cinderella in the story we all know; while the sisters of the family: astronomy, medicine, physics in general, pure science, even though it degenerate into pseudo-science, go about caparisoned in all the splendor of millions of endowment, and amidst the plaudits of the multitude. One endowment only exists as yet for the development specifically of applied science or engineering—the Engineering Foundation,—begun by Ambrose Swasey, of Cleveland, Ohio; and it is most gratifying to the writer to have been allowed to endeavor to illustrate some of the work of which such an endowment is capable.

INADEQUATE LABORATORY FACILITIES

Although expressing appreciation of the laboratory facilities afforded him for his tests at the Massachusetts Institute of Technology, scattered through the paper are a number of indications of the limitations on the tests due to inadequate facilities. These are brought together here for no other purpose than to reinforce Mr. Herschel's plea for a hydraulic laboratory—one not beset by such limitations. On this subject Mr. Herschel first remarks that the perfection of the laboratory details had been, and rightly, delayed by the war, and that doubtless its "many remediable defects" will be "eliminated in the course of time." A specific obstacle mentioned is "surgings" in the canal supplying the laboratory, indicated in the pump-well surface and pump discharge. The work of "two whole afternoons," Mr. Herschel says, "were rendered useless from this cause."

Another limitation was the turbulence due to the free discharge of the used water. "It would have been gratifying," Mr. Herschel says in his paper, "to remove some or all of these crudities, and also to extend greatly the scope of the experiments; but the limitations of the appropriation available forbade going beyond the work that was actually done."

Besides the limitation due to physical handicaps and inadequate funds, there was also a lack of time caused by the fact that a college was supplying laboratory facilities that could not be extended beyond vacation time. This is regretfully expressed by Mr. Herschel, who then pleads the need for "a hydraulic observatory," as follows:

> A crew of six men, including three observers, with a captain, had been working with the apparatus from Sept. 10 to Oct. 3, 1919, and it was with great regret that the writer gave the order to dismantle the weir because so much remained to be discovered.
>
> But Oct. 3 was Friday, the last day of the week for us. The Laboratory closed at 5 p.m.; and on Monday the regular school term commenced. The appropriation for the work was nigh exhausted and it was high time we quitted the premises.
>
> There was, first of all requiring further investigation, the effect of the radius of the weir crest. Bazin had experimented on a weir composed of two 2:1 slopes meeting at a sharp angle and with a little pipe to indicate pressure "under the nappe," *let into the body of the weir slope upstream from the crest.* This cannot enlighten us very much, but is the nearest approach to our experiments known to the writer.
>
> Our weir crest had a radius of 0.198 ft., and the outside surface was hard and smooth oil paint.
>
> No doubt the radius of the weir crest is a factor in the application of the formula found for weirs of the construction shown in this article, but it remains for other sets of experiments to reveal the limits and detailed effects of this radius.
>
> This illustrates the need there is for a hydraulic observatory, to be conducted on similar lines to those followed for so many centuries in astronomical observatories. There should be somewhere a hydraulic observatory whose work should go on continuously. It requires a trained and experienced crew and more time than we had to do work of full effect. The situation in the United States is much better than it was only twenty years ago when the hydraulic laboratory of Cornell University, the first one built in this country, was constructed. There are now at least half a dozen such laboratories, at Wisconsin, Illinois, Indiana, Iowa and no doubt other state universities, and others are projected. What is next needed is a hydraulic laboratory devoted to hydraulic experiments and sufficiently endowed, so that it may bring certain aims of experiments to a conclusion and so that it may keep continuously employed the persistent efforts of trained men with a proper and permanent apparatus.
>
> An example of the opposite method of proceeding is furnished by the experience of engineers with the venturi meter. Invented in 1886, more than thirty years ago, only a few experiments are as yet available to portray the laws that govern its action. It has accomplished much in the course of its life of thirty years, but it could have accomplished more, and that sooner, had there been a hydraulic observatory to teach its laws and qualities. During the first ten years of its life it was used only by its inventor, which is another illustration of the need of experiments which the working engineer cannot be expected to have opportunity to make in such cases.

This closes the extracts from the paper. In an interview with a member of the editorial staff of this journal, Mr. Herschel brought out some further points worthy of record here.

COLLEGE LABORATORIES DO NOT MEET NEED

Prior to the Francis experiments at Lowell, the few hydraulic experiments that had been made by Gugielmini at Parma, Italy, and by Dubuat and others in France were on a small scale and were designed to establish the laws of hydraulics generally rather than to combine their discovery and their application to practical problems. At Lowell, as has been brought out by the foregoing citations from the paper, the motive of the tests was the measurement and division of water for power. Later on, at Holyoke, Mr. Herschel, by convincing the water-power owners that a testing laboratory would pay for itself through tests made for outsiders, was enabled to make the tests that gave the world the venturi meter.

England, Mr. Herschel observed, has done nothing along the line of the "hydraulic observatory" idea, while Germany has confined its efforts to waterwheel or turbine tests by manufacturers, like the many that have been made in the United States. Cornell University gave this country its first great college hydraulic laboratory, and its example has been followed by many other technical schools. But all that has been done here by water-power owners, pump and turbine manufacturers, and the colleges does not meet the need, Mr. Herschel urges, for a great "hydraulic observatory," free from such physical, time and financial limitations as were encountered in the weir tests described in his paper.

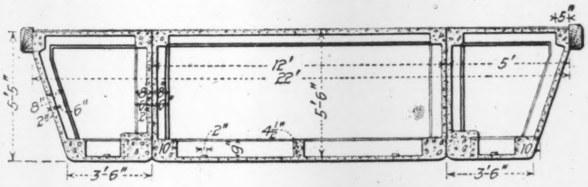
Happily, Engineering Foundation was able and willing to come to the aid of the Power Test Code Committee, last autumn, with the funds that established the principle of his new weir, Mr. Herschel said. But the funds were limited, and for some two years to come Engineering Foundation has all available test funds committed to tests on the fatigue of metals.

Later on, Mr. Herschel hopes that Engineering Foundation may have funds to devote to hydraulic studies. By that time, the new power plants at Niagara Falls, on both sides the river, will be completed and one of the old plants, it is hoped, may be made available for continued hydraulic tests. Pending both these hoped-for developments, Mr. Herschel, through the columns of *Engineering News-Record,* urges engineers, manufacturers of power, pumping and other hydraulic apparatus, and public and private users of water and water power, to work, individually and collectively, for a "hydraulic observatory" worthy of America.

Articulated Concrete Barge for Dredge Crane

A CONCRETE barge capable of being separated longitudinally in three parts so as to permit the central part to pass through narrow rock has been built for the South Level Commission, Ely, England, to be used to carry a dredging crane for the drainage work on the River Ouse. The barge is described in *Engineering* (London) April 30, 1920.

It consists in effect of three reinforced-concrete barges having an over-all length of 72 ft., an over-all beam of 22 ft., and a draft when fully loaded of 3 ft. 9 in. The center barge is of rectangular section 12 ft. wide and the two outside sections trapezoidal as shown in the accompanying sketch. The outside sections are connected to the middle one by four steel beams fitted with necessary bearing plates and secured by bolts. These sections are readily detachable so as to allow the passage of the vessel through the lock, the central section then carrying the crane equipment on a draft of 4 ft.



SECTION THROUGH THREE-PART CONCRETE BARGE

This barge was built during the war and at a time the quotation on steel barges of the same general design was £1,500, whereas the actual cost of the concrete barge was £839. The concrete is a 1:1⅓:2⅓ mixture of sand and broken granite. The crane is mounted on the central section on a square casting about 7 ft. and specially heavy crossbeams are provided under the bearing. The vessel was designed by E. G. Crocker, consulting engineer to the South Level Commission.

Chicago Plan Commission Report on Ten-Year Activities

TWELVE public improvements promoted by the Chicago Plan Commission and now being carried out represent the work of the first ten years of the commission, as outlined in its recent report for the decade 1909-1919. These improvements comprise the widening and extension of Michigan Ave. ($14,900,000), Roosevelt Road ($8,303,000), Western Ave., Ashland Ave. and Robey St.; the extension of Ogden Ave. across the city to the lake front; the widening and double decking of South Water St.; the West Side railway passenger and freight terminals and street approaches; the lake front improvement from Grant Park south to Jackson Park; the Illinois Central R.R. terminal reconstruction and electrification; the acquisition of 14,250 acres of forest preserve, and the development of an outer highway system.

Toward the cost of these improvements the people have voted $61,500,000 of bonds; the special assessments for Michigan Ave. and Roosevelt Road amount to $8,125,238; the railway companies have agreed to spend $162,091,350, and the Forest Preserve Commission has spent $5,316,762. All these projects are expected to be completed within the next five years, except the electrification of the Illinois Central R.R. and the lake front improvement south of 39th St.

Other projects under consideration include the straightening of the Chicago River to give additional north and south thoroughfares; the lake front boulevard north from Grant Park to Lincoln Park; the West Side post office ($6,000,000 site); widening and improvement of streets in the business district; the civic center, and the zoning and housing problems.

A comprehensive project for a "Plan of Chicago," providing for a systematic series of improvements on the basis of public welfare and civic development, was originated several years ago by the late Daniel H. Burnham, the Chicago architect whose fame became world-wide as the result of his architectural scheme for the Chicago Columbian Exposition of 1893 and his later work in city planning. With the backing and financial assistance of the Commercial Club the plan was developed under his direction and was presented to the city in 1909 with the request that a commission should be appointed to study the plan and to recommend what parts should be carried out first.

The Chicago Plan Commission was appointed on Nov. 1, 1909, by the late Mayor Fred A. Busse. It is a permanent department of the city government and its members are appointed by the mayor and approved by the City Council. Its work lies in the design and promotion of public improvements included in the "Plan of Chicago." In its first ten years, however, the commission has received only $100,000 from the city for its maintenance and work, so that it could not have accomplished much except for the assistance of the Commercial Club, which has contributed about $167,000. Including $85,000 expended for the original plan, $52,000 paid to the technical staff before the commission was appointed, and $12,000 subscribed for 1920, the Club has contributed over $300,000 for the "Plan of Chicago." The commission is composed of about 300 members, including engineers, architects, business men, and city officials. Charles H. Wacker is chairman; Frank I. Bennett, vice-chairman, and Walter D. Moody, managing director.

The Professional Spirit in Engineering Education

—An Opportunity for Service

By C. R. Mann
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THE achievement of a worthy professional recognition by engineers is still the subject of much discussion. Certain suggestions as to how engineering schools could proceed to develop men of professional attainments were presented in the study of engineering education which was made in co-operation with the national engineering societies and the Carnegie Foundation for the Advancement of Teaching and was published in 1918. The conclusions of this study were drawn and the manuscript prepared for the printer before the nation had proceeded far in its participation in the world war, or had time to analyze its experiences. The conclusions therein as to the necessity for beginning the study of engineering with real jobs and as to the importance of considering questions of values and costs in engineering instruction are still valid. But there is one additional fundamental element which was not clearly discerned before the war but which should be added if the finest results are to be obtained in the way of professional spirit among engineers.

> Whether the national spirit of service remains free and active, or is pent up until released by the next war, depends largely upon public education
>
> Current schooling is conspicuously designed to inspire the individual to make the most of himself for the sake of his own success. The required training must inspire the individual to make the most of himself for the common good.

THE SPIRIT OF SERVICE

The world war opened our eyes to a new vision. However satisfied and happy and contented we were before the struggle, there was a thrill and an inspiration about the war work that made every man who served able to do more work and better work than ever before. There was a resurrection of the pioneer soul of our forefathers, a release of the spirit of service and sacrifice which converted a relatively humdrum existence into a life of reality and grim adventure. The joy and the tragedy of it permeated every household. We lived as a united nation for a few months. Then the crisis passed and the commonplace routine settled down once more.

No one wants war. Yet millions would feel that life was more worth while if the spirit of service and sacrifice that prevailed during the war could continue to prevail in time of peace. Nor is it inconceivable that this might be so. The problems and perplexities of peace, though less dangerous to life and limb, are no less difficult of solution. Their mastery is no less a challenge to the soldierly virtues, as defined by William James in his "Moral Equivalent of War," than is the winning of a battle or the conquering of a continent. Because they are less spectacular, they demand even greater determination, resourcefulness and the endurance that makes defeat impossible.

Whether the national spirit of service remains free and active or is again pent up until released by the next war, depends largely upon public education. And since the tone and attitude of public education is intrinsically determined by the professional schools, there exists at the present moment for these schools the finest opportunity that ever came to any institutions to contribute to the upbuilding of a democratic nation. Quick action will bring larger returns because the crust of the commonplace is rapidly forming over the pioneer spirit; and the thicker the crust, the harder to shatter it and liberate the creative energy within. Like all elemental things, the thing that needs doing is very simple. It consists in first searching out the fundamental distinction between teaching as it is and teaching as it must be to produce the desired result, and then modifying curricula and instruction accordingly. As a beginning of this search, it is suggested for discussion that the essential fundamental distinction sought may be thus expressed: Current schooling is consciously designed to inspire the individual to make the most of himself for the sake of his own success. The required training must inspire the individual to make the most of himself for the common good.

The former leads the student to think in terms of competition—of "doing" the other fellow; it gives rise to such ever-present expressions as "what do I get out of it?" and "I should worry." The latter emphasizes co-operation, develops team-play and is expressed in the motto "United we stand, divided we fall." The former encourages working for wages and profits; the latter makes the joy of production uppermost and demands just apportionment of rewards.

A practical example will help to make this distinction clearer. The design of a warehouse is a typical project in the professional courses as now given in engineering schools. The student is given in class a verbal or written specification of the conditions to be met—the nature of the chosen site, the transportation facilities, the size, the load to be carried and the limits of cost. He then goes to work with pencil and paper, under the guidance of the instructor, to make a plan. In the process he looks up necessary data in standard tables and learns much about uses of various materials and about standard practices in warehouse construction. The work is criticized by the instructor, but the building is never built.

From paper problems such as these the prospective engineer gains much technical information and a fair degree of technical skill in drawing and figuring. His imagination is given a chance to function and his ingenuity is put to a test. As a result he is better prepared to undertake a similar piece of work for an industrial firm or to secure employment in an engineer's office. Through a series of similar exercises he ultimately becomes a technical expert who can earn his living in an eminently useful calling. Still, the fact remains that relatively few of the graduates of engineering schools win recognition as professional men.

PROBLEMS FROM REAL LIFE

In contrast with the current type of work just described, suppose that the professional studies in engineering schools were directed toward solving the problem of making the immediate environment of the school the best possible place in which to live. Instead of merely learning the technique of material construction, the student would investigate such public services as the water supply, transportation, electric light and power, markets, food supply, sewerage, disposal of waste, or any other of the many activities that contribute to the physical comfort of communities. The prospective engineer would then be compelled to appraise the operation of all these agencies, both in terms of public value received in proportion to cost and in terms of scientific and technical perfection. He would have to recommend changes in existing plants, to project and design new construction and to suggest reorganization of present systems of transportation, marketing, heating, lighting, and the like. He would thus be constantly solving not only the problems of material construction, which usually occupy practically all the time in current instruction, but also those more fundamental problems of relative values and costs from the point of view of public welfare.

> A technical school surely does not realize its true destiny when it is merely a factory for quantity production of standardized, technical and intellectual skill.
>
> The engineer builds for people, not for individuals.
>
> The crust of the commonplace is rapidly forming over the pioneer spirit.

This idea is not new. About 40 years ago, a professor of civil engineering at Columbia University, aroused by his own observation of the inconvenience of transportation in New York, set himself the problem of working out a system of rapid transit. He studied the problem himself and for a number of successive years set portions of the problem as exercises for the senior class. Eventually one student developed a profound interest in the study and that young man became the chief engineer of the subway system. Other schools have made similar studies to a limited extent and in every case they have found that students work with a new spirit on projects of this kind. Not only do they learn rapidly, but they also secure some conception of the complexity of the problems of values and costs. In addition they experience the joy of contributing by constructive work toward making the community a better place to live in.

Problems of the sort suggested exist in plenty in every community, large or small. The delivery system in a small town is usually a splendid example of inefficiency and waste. There are perhaps three or four groceries and markets, each of which maintains a complete system of delivery to all parts of the town. Wagons make long trips with few parcels. An organization of the delivery system could easily be made, much to the benefit of both consumer and dealer. Similarly, in large cities like New York, Boston or Chicago, traffic is almost impossible during the working hours because of the lack of system and organization in the handling of freight. Co-operation, careful planning, a good system could reduce the congestion, reduce cost and expedite the handling of goods. Individual dealers are not likely to take the initiative in developing such a co-operative system; but a simple and sensible scheme, worked out solely from the standpoint of public welfare by a disinterested institution, would have a large chance of being accepted and quickly put into effect.

The possibilities in the way of developing the spirit of service which is after all the true professional spirit, through service of the public in the manner suggested are without bound. Suppose that some engineering school should set itself the problem of determining how the state or town in which it is located could be made more productive and in every way a better place to live in. Instead of confining its efforts largely to developing technical skill and imparting information to its students, the institution would organize its instruction so that the students would secure their technical skill by solving problems of vital interest to the public. What are the mineral resources of the state, and what steps might be taken to utilize them for the public benefit? Are the industrial resources of the town fully developed? What incentives could be applied to stir local initiative for their further development? The great project of building state highways is now being formulated. How can this achievement be co-ordinated with industrial production so as to yield the greatest returns to the people of the state? What measures of public health and what legal enactments would tend to improve sanitary conditions and commercial activities? If engineering schools should undertake to make practical scientific studies of problems like this, and if they should always cling close to the ideal of public welfare, it is safe to predict that larger appropriations and more generous public support would soon solve the problem of teachers' salaries, that a finer and freer professional spirit would burst forth among the students and that the creative energies of the people would be released in greater production. All this would inevitably result in greater prosperity and a loyalty to the commonwealth and the nation equal to that called forth by the war.

NEW EDUCATIONAL TREND APPARENT

The signs of the times indicate that work of this kind is rapidly gaining in favor in graduate and professional schools. The National Research Council, through its states relations section, is now studying methods of organizing for this end. The University of Wisconsin is conducting work of this type in regard to irrigation of farm lands. It is a great adventure on which they are entering and the possible returns are enormous. The spirit of service and sacrifice is contagious; it is, perhaps, one of the instinctive motives of men. It operates with a power that brooks no defeat. If the cultivation of that spirit were sanctioned by professional schools as the distinguishing mark of the professional man, the lower schools would rapidly follow suit. Then creative imagination would find freer fields for exercise, pent up energies would be released in constructive work, and there would be more artists and fewer artisans, more scholarship and less scholasticism.

A technical school surely does not realize its true destiny when it is merely a factory for quantity production of standardized, technical and intellectual skill. Professional attainments cannot be gaged with a stop watch or measured in terms of student clock hours and semesters. Nor are these practices longer needed. University professors were assigned by the hundred to positions of great professional responsibility in the war organization. They have demonstrated their compentency as experts in developing the machinery of destruction and death. Surely they are no less capable of leadership in discovering more intelligent processes of production and life.

For centuries the clergyman, the physician and the lawyer have ministered to the intimate personal longings and aspirations of men. Unquestionably, this fact had large significance in determining the popular recognition of these three oldest of the learned professions. The engineer builds for people, not for individuals. His work is necessarily impersonal and without intimate association with those he serves. Yet when he works, as thousands of engineers did during the war, under the inspiration of a spirit of service for the public good, no one questions his status. All are ready to do him honor and grant him credit for public service well done.

Organic Impurities Injure Concrete

TESTS made in the Structural Materials Research Laboratory with the co-operation of Lewis Institute and the Portland Cement Association show that the long recognized injurious effect on concrete of organic ingredients is a fact. These tests, reported by Prof. Duff A. Abrams at the recent meeting of the American Society for Testing Materials, give quantitative results. It was impossible to secure natural sands containing graduated percentage of organic impurities for a study of the quantitative effects of such impurities, so the laboratory prepared aggregate samples in which known quantities of organic impurities were present by applying tannic acid as a surface coating in quantities up to 0.4 per cent by weight. Compression tests were made on 3 x 6-in. concrete cylinders. The mix varied from 1:5 to 1:2; the size of aggregate ranged from fine sand to a ¾-in. graded aggregate. Tests were made on all mixtures and sizes of aggregate at ages of seven days, twenty-eight days, three months, one year, and two years. Specimens were stored in damp sand. The series included about 2,000 concrete tests. The following are the principal conclusions from the investigation:

The strength of concrete was reduced for all percentages of tannic acid, for all mixes and ages covered by these tests. Less than 0.1 per cent of tannic acid in terms of the weight of the aggregate may reduce the strength of the concrete to one-half its normal value.

Lean mixtures are more affected by tannic acid than rich ones.

The mixtures from the finer aggregates are less affected by tannic acid than those from the coarser aggregates.

All of the effects mentioned above may be summed up by saying that the reduction in strength of concrete is a function of the *concentration* of tannic acid in the mixing water. An equation is given which represents this relation for the 28-day tests.

The results of these tests indicate that the wetter consistencies would be less affected by the presence of organic impurities than the drier ones.

The strength falls off rapidly for small percentages of tannic acid and less rapidly as higher percentages are reached.

The 7 and 28-day strengths are reduced to a greater extent by tannic acid than at ages of 1 and 2 years.

Some of the 1:5 mixes in which the higher percentages of tannic acid and the finer sands were used (2 to 3-per cent solution) disintegrated before the time of test. The 1:7 mixes (3 to 5-per-cent solution) were destroyed in removing the molds.

The tests confirm the results of many other investigations made in this Laboratory in showing the fundamental dependency of strength of concrete on the quantity of mixing water as expressed by the water-ratio.

The strength of concrete (stored in a damp place) both with and without tannic acid increased with age. The strength for a given condition was a logarithmic function of the age.

Recommends Study of New Terminal for Hudson Bay Railroad

FURTHER study of Churchill Harbor, instead of Nelson, for the northern terminus of the Hudson Bay Ry. is recommended in the report just made by the Canadian Senatorial Committee appointed three years ago to study the possibilities of the Hudson Bay region and the feasibility of the railroad. The committee recommends that the Government make no further expenditures on the development of the harbor at Nelson until a thorough study has been made of the possibility of building the line to Churchill Harbor and making developments at that point, which is about 150 miles northwest of Nelson, at the mouth of the Churchill River. The committee also states that the Hudson Bay route is feasible and will probably be profitable in time, pointing out great natural resources from the fishing and mining industries.

The committee states that "sufficient care was not taken in the selection of Nelson as the terminus for the Hudson Bay R.R., and that the Government should not make further important expenditures on this port without first making a new and thorough examination as to the relative merits of Churchill and Nelson as the terminus for the railroad." To utilize Nelson, however, many witnesses stated that it would be necessary to build about eighty miles of railroad across country which included thirty miles of morass land over which it would be almost impossible to build a roadbed. This was denied by other witnesses who claimed that a good and comparatively short route could be obtained by deflecting from the present route some fifty miles south of Nelson. Advantage is claimed for Nelson as "an absolutely land-locked harbor entirely protected from wind from any direction," while it is pointed out that Nelson is exposed to easterly gales. In conclusion the committee recommends the appointment of a sub-committee of engineers to examine the route to Churchill and ascertain whether it is practicable, in the meantime extenting the rails to Nelson but suspending harbor work at that point.

It is stated that there is a great opportunity for the development of a valuable fishing industry and a large mining industry, and that mines already discovered in the Hudson Bay district are of such nature as to indicate the existence of great mineral wealth. Navigation is open at least four months in the year and may be extended.

Mare Island Pontoon Crane of 150-Ton Capacity

Heavy Structural Features Include 1,000-Ton Step Bearing and Long Luffing Screws Without Intermediate Bearing—205 Tons Lifted in Test

A 150-TON pontoon crane put in service last year in the Navy Yard at Mare Island, Cal., is a noteworthy piece of heavy structural design. The main step bearing which carries the weight of the rotating element has a maximum load of 1,000 tons. Luffing the jib is done by a pair of 9-in. screws unsupported for 37 ft., which engage a crosshead. The crane lifted and swung a 205-ton load of armor plate in the acceptance test. A complete power plant is contained in the hold, so that the crane can operate independent of shore connections, but no propelling machinery is installed and a tug is required for moving the machine about except as it can pull itself along the waterfront by means of shore or anchor lines to the motor-driven capstans. Its total floating weight is about 2,600 tons.

During the year in which this crane has been in service at Mare Island it has been busy practically all the time, sometimes sixteen hours out of twenty-four. It first gained popularity with yard officials because it could handle the smaller boats that otherwise would have required the use of the drydocks, but in addition the placing of boilers, guns, armor plates and other heavy equipment has been done so much more easily with this crane than was formerly possible that it is now said to be one of the handiest pieces of equipment at the yard.

The steel pontoon which forms the support for the superstructure is 85 by 140 ft. in plan and 15 ft. deep. Full-depth collision compartments entirely surround it and there are also longitudinal and transverse bulkheads in the interior. Compartments for the boiler plant and generating unit are in the after end, and have an open hatchway covered by a deck house. One end of this deck house is enclosed so that it may be used as the crane office.

The superstructure is located on the longitudinal center line of the pontoon with its center 42 ft. from the forward end. A fixed tower 43 ft. high, which is secured to six bulkhead plates extending through the deck of the pontoon, surrounds the lower part of the rotating structure, called the pintle. The entire rotating element of the crane consists of three parts, the pintle section, the machinery section and the jib. The pintle section rests on a heavy step bearing attached to the deck, and extends above the top of the fixed tower, within which it rotates. The jib is hinged to the front side of the pintle section 60 ft. above the deck with hinge pins 24 in. in diameter. At the rear, the pintle section is extended to form a support for the machinery section in which all of the operating units are located. In this location the machinery helps to counterbalance the jib, thereby reducing the weight of concrete ballast required.

All of the motions of the crane are controlled from the operator's cab which is located on the rotating structure just below and to the right side of the jib hinge pin. The jib is luffed by a screw-operated crosshead which travels in vertical guides at the rear of the machinery section and is connected to the upper chord of the jib by heavy links. These links have 18-in. pin connections at both ends. The jib is approximately 125 ft. long and when in its highest position its top is 190 ft. above the water.

The main hoist, designed for a capacity of 150 tons at a radius of 105 ft., which gives a reach of 62.5 ft. beyond the fender line, consists of two separate units, arranged to be connected when handling capacity load. Their hook blocks are suspended from a fixed position on the jib and operate at a rate of 4 ft. per minute from any position between 25 ft. below to 95 ft. above water level.

A hook block for handling loads under 25 tons is suspended on a trolley which travels along the under side of the jib. This hoist has a vertical range from 25 ft. below to 130 ft. above water level. It can handle a capacity load at a speed of 12 ft. per minute or a 5-ton load at 60 ft. per minute. The jib when carrying the maximum load can be luffed from its lowest position to the highest in 15 min., and in the reverse direction in about 11 min. A complete rotation of 360° under full-load conditions requires between 4 and 5 minutes.

Each of the two 75-ton main hoist blocks is operated by a winding drum connected by three spur-gear reductions to a 40-hp. series-wound motor. An electrically operated disk brake is attached to the motor pinion shaft, and so connected that it sets instantly when the current is cut off the motor. In addition to this, there is also a mechanically operated band brake for emer-

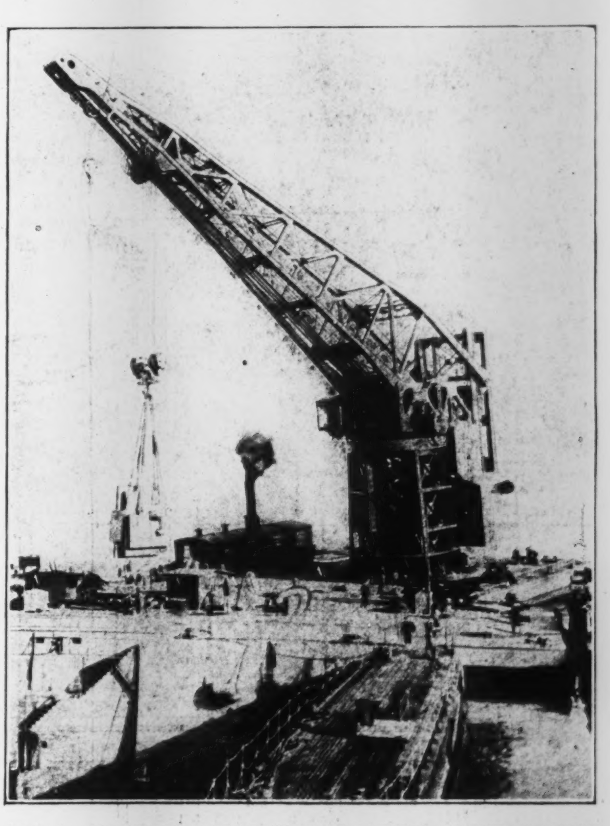


FIG. 1. MARE ISLAND 150-TON FLOATING CRANE MAKING A FULL-CAPACITY LIFT

gency use only, this brake being attached to the intermediate shaft. Two 1½-in. steel cables lead from the drum around deflecting sheaves to the 75-ton hook blocks. The gearing is proportioned for a hoisting speed of 4 ft. per minute with a 75-ton load and 8 ft. per minute at half load. The two main hoisting units are located in the lower part of the machinery section of the rotating structure. When it is desirable to operate these two units simultaneously they may be positively connected by a jaw clutch. A master switch in the operator's cab operates the magnetic switch controller which regulates the hoisting mechanism. The magnetic controller is provided with a dynamic braking device to give positive and accurate control when lowering heavy loads.

The 25-ton auxiliary hoist block is operated by a hoisting unit located in the machinery section of the rotating structure directly above the main hoist units. The motors are of the same capacity, and control and automatic braking devices are similar to those of the main hoist. This block is suspended from a movable trolley which travels along the under side of the jib.

The mechanism for moving this trolley is located over the auxiliary hoisting mechanism. Because the jib, in its highest position, is nearly vertical, the front trolley ropes are required to take practically all of the hook load, and with the boom in its upper position the load is raised as the trolley is moved toward the outer end of the jib. On the other hand very little pull is required in the reverse direction. The mechanism for this motion includes 40-hp. motors and control equ ment similar, in the main, to the other two units.

The jib is luffed by a crosshead moving in verti guides at the rear of the rotating structure which co nects by two links to the back of the jib. The verti movement of the crosshead is controlled by two screw connected by bevel and spur gearing to two 40-hp. seri motors which have the usual braking and control equip ment. The thrust on these screws is carried by tw conical roller bearings, each of which is designed fo a load of about 450,000 lb. The screws, of forged steel. are 9½ in. in diameter and about 52 ft. long, with suff cient thread to produce a crosshead travel of about 37 ft. in about 15 minutes.

The entire rotating structure is supported by a single step bearing secured to the deck of the pontoon in the center of the fixed tower. Under full-load conditions this bearing carries a horizontal thrust of about 700,000 lb. and vertical pressure of about 2,000,000 lb., which is carried on three disks, two of bronze and one of steel, all 44 in. in diameter. Oil is pumped between these disks through a hole in the axis from which it

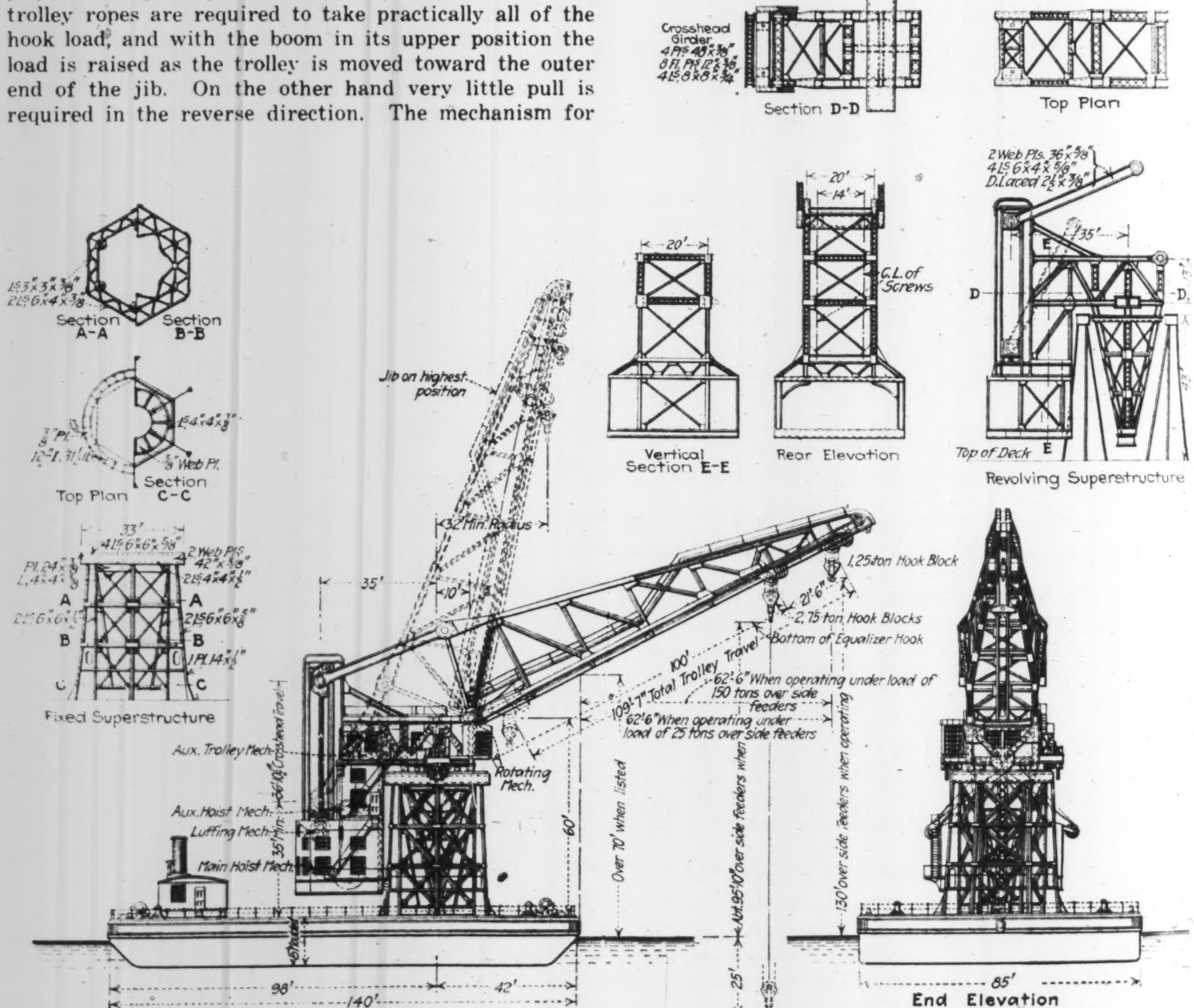

Crosshead Girder
4 Pls. 48"×⅝"
8 Fl. Pls. 12"×⅝"
4 Ls. 8×8×¾"
Section D-D
Top Plan
2 Web Pls. 36"×⅝"
4 Ls. 6"×4"×⅝"
D. Laced 2½"×⅜"
35'
E
D
D
Top of Deck
E
Revolving Superstructure
20'
Vertical Section E-E
20'
14'
C.L. of Screws
Rear Elevation
1 Ls. 3"×3"×⅜"
2 Ls. 6"×4"×⅜"
Section A-A
Section B-B
⅜" Pl.
12-1.31½"
Ls. 4"×4"×⅜"
⅜" Web Pl.
Section C-C
Top Plan
33'
4 Ls. 6"×6"×⅝"
2 Web Pls. 42"×⅜"
Pl. 24"×⅜"
L, 4"×4"×⅜"
2 Ls. 4"×4"×½"
A
A
2 Ls. 6"×6"×½"
2 Ls. 6"×6"×⅝"
B
B
1 Pl. 14"×½"
C
C
Fixed Superstructure
Jib on highest position
32' Min. Radius
35'
10'
1,25-ton Hook Block
21'-6"
2, 75 ton Hook Blocks
Bottom of Equalizer Hook
100'
109'-7" Total Trolley Travel
62'-6" When operating under load of 150 tons over side feeders
62'-6" When operating under load of 25 tons over side feeders
Aux. Trolley Mech.
36'-10½" Crosshead travel
Rotating Mech.
Aux. Hoist Mech.
Luffing Mech.
Main Hoist Mech.
35' Min.
60'
Over 70' when listed
Abt. 95'-10" over side feeders when
130' over side feeders when operating
25'
98'
42'
140'
Side Elevation
85'
End Elevation

FIG. 2. GENERAL ARRANGEMENT OF MARE ISLAND CRANE

flows outward in radial grooves which do not reach quite to the edges of the plates. Thus, so long as the pressure is maintained the heavy rotating element is virtually floating on a film of oil.

The oil pressure system is very simple, consisting of a 15-gal. reservoir for lubricating oil and a hand pump which is given attention only occasionally. At first there was a high rate of oil loss from this bearing but after the careful adjustment of the copper packing glands the quantity used was reduced to about 5 gal. per month. When the hand pump is operated after the oil pressure has been released, the rotating element can be seen to rise about $\frac{1}{16}$ in.

The bearing proper, which is carried on the discs, consists of steel castings in the form of a ball and socket to ensure perfect alignment. The ball or upper casting is finished on top as an eight-section jaw clutch. The upper half of this clutch is the bottom casting on the pintle and the two parts are held together by the weight on the bearing. Play of about $\frac{1}{4}$ in. was purposely left in the fit between the two sections of the jaw clutch.

The rotating structure is maintained in vertical position by a horizontal roller bearing ring completely enclosing the pintle section of the rotating structure. Sixty cast-steel rollers held in a circular frame comprise this horizontal bearing. A circular tread surrounding the rollers is secured to the top of the fixed structure about 43 ft. above the deck. A bevel gear ring 29 ft. in diameter is secured to the fixed structure and meshes with two bevel pinions carried on the rotating structure at diametrically opposite points. The pinions are geared by three reductions of cut spur gearing to separate 40-hp. series motors, and the gearing is proportioned to

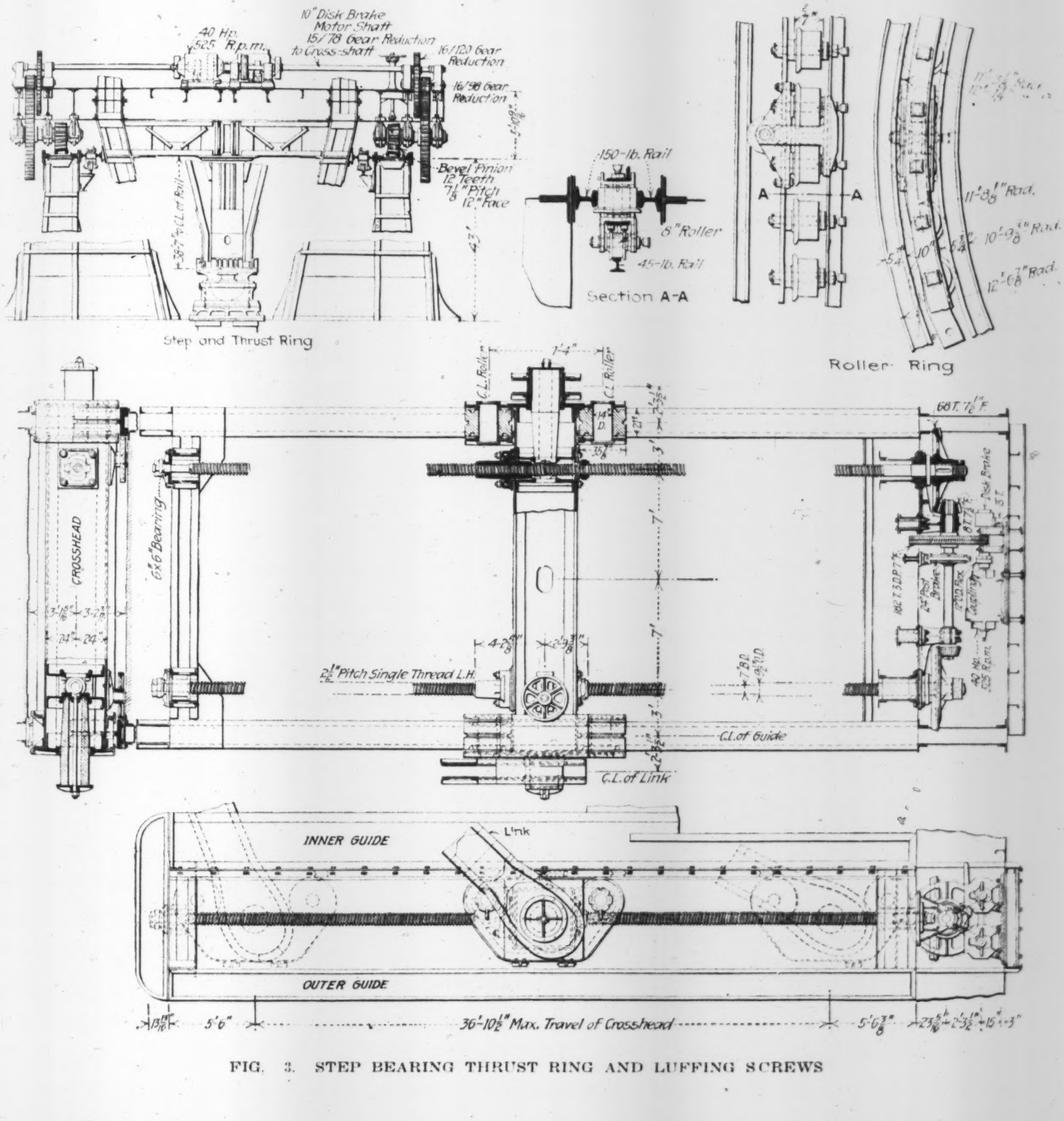

40 Hp.
525 R.p.m.
10" Disk Brake
Motor Shaft
15/78 Gear Reduction
to Cross-shaft
16/120 Gear Reduction
16/98 Gear Reduction
5'-10 9/16"
Bevel Pinion
12 Teeth
7 1/8" Pitch
12" Face
38'-7" to C.L. of Rail
43'
Step and Thrust Ring
150-lb. Rail
8" Roller
45-lb. Rail
Section A-A
A
A
7"
11'-8 1/8" Rad.
10'-9 5/8" Rad.
12'-6 7/8" Rad.
5 1/4"
10"
6 3/4"
Roller Ring
C.L. Roller
1'-4"
C.L. Roller
14" D.
21"
35/8"
2'-3 1/2"
3'
7'
7'
3'
68T. 7 1/2" F.
Disk Brake
ST.
8T. 7 1/2" F.
182 T. 3 D.P. 7" F.
24" Post Brake
12" O.D. Flex. Coupling
40 Hp.
525 R.p.m.
CROSSHEAD
6"x6" Bearing
3'-1 15/16"
3'-2 3/16"
24"
24"
4-2 5/8"
2'-9 3/8"
2 1/2" Pitch Single Thread L.H.
7" B.D.
9 1/2" O.D.
C.L. of Guide
2'-3 1/2"
C.L. of Link
INNER GUIDE
Link
OUTER GUIDE
1 13/16"
5'6"
36'-10 1/2" Max. Travel of Crosshead
5'-6 3/8"
2 3/16"
2 3/2"
1 1/2"
15"
3"

FIG. 3. STEP BEARING THRUST RING AND LUFFING SCREWS

produce a complete revolution in 4 min. under full load.

Electric current for operating the motors and lights is supplied by a cross-compound marine engine direct-connected to a 150-kw. 250-volt d.c. generator. The power leads from the main switchboard terminate in contact shoes attached to the fixed tower and engaging collector rings on the rotating structure. Steam for the engine generator set and for two steam-driven windlasses is supplied at 150-lb. pressure by a 200-hp. Scotch marine boiler.

Four capstans driven by 15-hp. motors are located at the corners of the pontoon. Internal gearing on these capstans is so arranged that the change from high to low speed is effected by simply reversing the motor. They exert a rope pull of 3,000 lb. at 40 ft. per min. At each end of the pontoon on the longitudinal center line is a steam anchor windlass designed to handle a 2-in. navy stud-link chain, which is stowed in a locker built into the pontoon directly underneath. These machines are driven by 10 x 10-in. steam hoisting engines.

The crane mechanism and crane structure itself were built by the Wellman-Seaver-Morgan Co., while the pontoon was constructed at the Mare Island Navy Yard from plans supplied by the contractors. The crane superstructure was shipped in pieces from the company's fabricating plant at Cleveland, Ohio, the largest single pieces shipped being the links connecting cross-head and jib. The assembly was made by the manufacturing company's force at Mare Island and the crane was put in service in February, 1919. The work was carried out for the Bureau of Yards and Docks, under the supervision of officers of the Civil Engineer Corps, U. S. Navy.

Hydro-Electric Power Development Begins in Nova Scotia

Provincial Government to Control Power Through Commission—Initial Project Just Started Near Halifax

IN THE Dominion of Canada there are two distinct policies of government control of hydro-electric power: One, represented by the Province of Ontario, vests all control of development and sale of power in a government commission; the other, represented by the Province of Quebec, puts on the government the duty of investigating hydraulic possibilities and developing storage, but licenses private companies to build and operate plants. Both systems in their respective provinces have been in successful operation for some years and their relative desirability is a subject of continual argument. One other province, Nova Scotia, just before the war adopted the Ontario idea; that is, the government ownership of hydro-electric plants, but it has only this year started the first practical application of the system by the construction of a plant near Halifax to supply that city with power.

Prior to 1914 no systematic investigations of water powers or water resources had been undertaken in any of the Maritime Provinces, but in that year, as a result of discussion in the Legislature of various power company charters, Nova Scotia appointed a water power commission to investigate the power resources of the province. This commission, in co-operation with the water power branch of the Interior Department of the Canadian government, started in 1915 to investigate the water-power possibilities of Nova Scotia. The work has been going on for about five years and involves water gaging, mapping, and study of prospective projects. The commission at the same time has comprehensive authority to develop power from water power and other sources as a public undertaking. It is in effect a trustee for the various municipalities of the province to supply power in bulk at actual cost. The distribution and sale of power within individual municipalities are matters which each municipality may take into its own hands. The operations of the commission are to be financed by the commission issuing its own bonds guaranteed by the province or by direct loans from the province. The commission's obligations for interest, sinking fund, maintenance and operation will be met by the sale of power, and the municipality's obligation to the commission is merely to pay the actual cost of power delivered to it by the commission.

While a number of the larger rivers of the province and a great many small sites have not yet been completely investigated, it is tentatively suggested that 300,000 hp. is the commercial capacity of the larger water-power sites of the province. There are no large rivers in Nova Scotia, but what there are are short and steep and provided with many lakes, especially on the higher elevations. These facts added to the advantage of a large rainfall offer a considerable inducement to the development of numerous comparatively small plants connected together in groups throughout the province. Such a construction will probably be the policy of the commission. A network of transmission lines are contemplated covering the greater part of the province, linking up and drawing energy from water-power and steam plants located at stragetic points. Furthermore, this system may be connected with a similar one in the Province of New Brunswick.

The first development to be undertaken by the Nova Scotia Power Commission is the development of about 12,000 hp. supplying the City of Halifax. This involves the storage of water on the Northeast River and the Indian River, which are west of Halifax and empty into the Atlantic Ocean at St. Margaret Bay. These two rivers are to be joined together, first into one power station under heads of 100 and 150 ft., and the joint water utilized again lower down at tidewater under 100-ft. head. The numerous lakes and the head-waters will be utilized to the fullest extent for storage purposes and some of these dams are now under construction. In general the design and the plants themselves consist of concrete head dams, wood-stave flume lines from 6 to 10 ft. in diameter, and concrete power stations equipped with vertical pipes and waterwheels. The present installation provides for transmission on steel towers to Halifax, 18 miles, at the generation voltage, and for distribution in Halifax from a receiving station for purposes of traction, light, and industrial use. The estimated cost of the entire development is something over $1,000,000, but only one of the upper dams and the lower dam are now under contract. The estimated cost of the present work is about $70,000.

The Nova Scotia Power Commission consists of E. H. Armstrong of Halifax, F. B. Whitman of Anapolis, and R. H. MacKay of New Glasgow. K. H. Smith is chief engineer and secretary, and C. H. and P. H. Mitchell, of Toronto, are the commission's consulting engineers on the Halifax development.

Nomographic Solution of Cubic Equation

By S. Okabe
Civil Engineer to the Department of Home Affairs of Japan

Engineers not infrequently encounter the cubic equation as in determining the rise in surge tank and penstock design. For convenient use in such cases the writer submits a nomographic solution of the cubic equation.

The general equation is,

$$aX^3 + bX^2 + cX + d = O \qquad (1)$$

By putting,

$$X = x - \frac{b}{3a};\ p = \frac{3ac - b^2}{3a^2};\ q = -\frac{2b^3 - 9abc + 27a^2d}{27a^3},$$

the original equation (1) will be transferred to

$$x^3 + px = q \qquad (2)$$

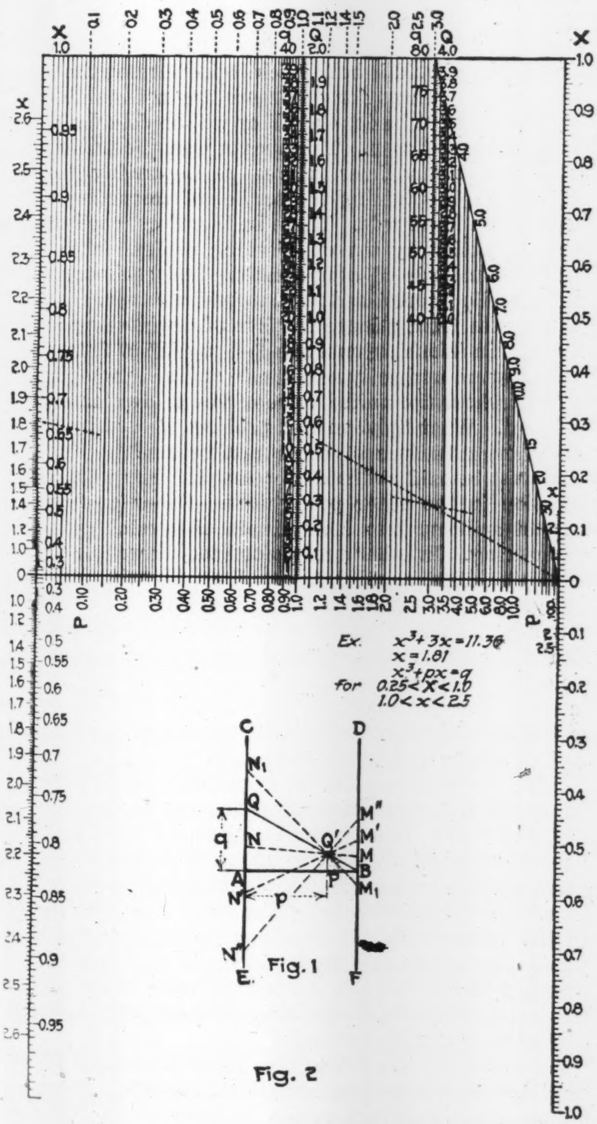


Fig. 1

Fig. 2

NOMOGRAPHIC SOLUTION OF CUBIC EQUATION

Solving the equation (2), the required roots of the original equation (1) will be found accordingly.

Following are the solutions of the equation with positive q. (If q be negative, then the root has the same value as that of the similar equation with positive q, but its sign is opposite.)

(*a*) *In the case of positive* p.—There is only one positive root. In Fig. 1 find the points P and Q on AB and AC axes where AP and AQ are equal to absolute values of p and q in the cubic equation. Find a point Q' which is the intersecting point of the straight line BQ and the vertical straight line through P. A straight line passing through Q' will cut the axes BD and AC at M and N. Revolve this line about Q' to the point where the scale readings at M and N coincide; then the graphic chart at this instant will satisfy the cubic equation, and the readings will be its roots.

(*b*) *In the case of negative* p and $\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3 > O$

There is only one positive root. The straight line passing through the point Q' will cut the axes BF and AC at M_1 and N_1, and if the scale readings at M_1 and N_1 coincide, the readings will be the root.

(*c*) *In the case of negative* p and $\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3 < O$

There is only one positive root, such as in the case (*b*), and two negative roots. If the readings N' and M' coincide, and also those at N'' and M'' coincide, they will be the negative roots of the cubic equation.

Practical application of the chart.—The accompanying chart (Fig. 2) can only be used to solve the cubic equation whose roots lie between 0.25 and 2.5. Hence it must, first of all, be ascertained whether the roots lie between the limits or not. If not, they must be driven into the limits by multiplying by 10^n; for that purpose the coefficients p and q in the cubic equation must be multiplied by 10^{2n} and 10^{3n} respectively. The scales (x) and (q) in the chart are to be used when the roots lie between 2.5 and 1.0, whereas the scales (X) and (Q) are to be used when they lie between 0.25 and 1.0.

Training of Future Railroad Officers

Training and education of future railroad officers will not be confined to specialzation in a single subject, according to a recent address by Major General Sir Henry W. Thornton before the Institute of Transport. "Education and training of competent officers of the railway," said Sir Henry, "is a matter in which the Institute of Transport can, and I have no doubt will, play a large part. The high railway officer of the future can no longer be exclusively skilled in the movement of traffic, or be a brilliant engineer or a great accountant. He will have to be all of these in a degree. An analyst primarily, with the ability to appreciate the full effect of such movements as we have lately passed through, the economic side of the problem and to foresee the future. There must be a call for men of better general education, of studious and scholarly habits of mind and judicial tendencies of thought. The day of the railway officer who follows precedent merely because it is such, and is complacent in establishing practices or dwells within the narrow confines of the department in which he was educated, is past."

How Other Professions Than Engineering Are Organized

Some of the Methods Employed by Lawyers, Doctors and Architects to Secure United Action by Large Memberships

BY CHARLES WHITING BAKER
Consulting Engineer, New York City

This article is particularly timely in view of the impetus given to the plan for a federation of American engineering societies at the Organizing Conference of engineer delegates, held in Washington, D. C., June 3-4.—EDITOR.

THE problem just now agitating the engineering profession, as to how it may effectively organize to deal with "welfare" questions, is a problem that other professions have had to face. In those professions, as in engineering, societies were originally organized for the advancement of the profession in technical knowledge. In recent years the demand has come that these societies shall deal with the compensation of the professional man and with the problems of public welfare in which the profession is directly concerned. In some of these other professions experience has already been gained in dealing with welfare matters.

Of course these other professions also have their ultra-conservatives—the men who hold that the sole purpose of a professional society should be to hold meetings for the reading and discussion of technical papers and to preserve them in finely bound "Transactions" to be placed on the shelf. The demand has been insistent, however, that professional societies shall act on the vital matters that affect the profession's welfare; and this demand has brought more action in some other professions than in engineering.

COMPENSATION AND UNIFORM FEES

First of all comes the demand for united action on the matter of compensation. There are conservatives who hold that it is undignified for a professional society to deal with matters of compensation and to attempt to limit competition among its members. One hears always the stock argument that, "You are going to make our society a labor union." It is worth while, therefore, to see what action other professions have taken in this field.

The American Institute of Architects has long had a standard schedule of fees, which it recommends for the use of practitioners. The institute's constitution, indeed, says that the schedule of fees "shall not be made mandatory"; but this does not lessen one bit its moral force, for as a practical matter it could hardly be made mandatory.

In the medical profession this matter of standard fees is handled by the local associations of physicians in accordance with local circumstances.

In the legal profession, there has been no action for standardizing fees and there are two obvious reasons for this. In the first place, legal service is of such variable character that it would be exceedingly difficult to frame a schedule of fees which would be generally applicable. In the second place, in a large percentage of law practice the lawyer's services are a necessity to the client and are charged for accordingly. A standard schedule of fees would probably be opposed by many lawyers because it would serve in many cases to protect the client against exorbitant charges.

In engineering practice the variety of work makes standardization of compensation almost as difficult as in the legal profession. Nevertheless that very dignified and learned society, the American Institute of Consulting Engineers, made up largely of the Nestors of the profession, has had a standard schedule of fees in force since its organization. Surely if these eminent leaders of the profession stand for this principle, the ordinary engineer is justified in approving it.

The average engineer, however, is on a very different basis from the architect, the doctor or the consulting engineer who gets his living from fees for service rendered. Probably 95 per cent of those engaged in engineering are employed on a salary. It may be claimed that fixing standard salaries for engineering services is on a different basis from fixing standard fees, and yet why should it be? Each is justified on the basis that if living wages for engineers are not maintained, the work will not be done at all or will be done by cheap and incompetent men. This means that the public will suffer a loss many times as great as any saving it could make through obtaining the service of competent engineers at too low a rate. There is, therefore, good precedent for action by the engineering profession to protect its standards of compensation, and such action is in the public interest and not antagonistic to it.

Delegates from a large number of engineering societies met in Washington June 3-4 to plan a federation so that some authority can speak and act promptly on matters where the united voice of the profession should be heard. What light on this problem is shed by study of the organizations of other professions?

It must be said at the outset that there is no parallel situation in the other professions. Other professions are not split up into a multitude of specialties, as is engineering. In other professions too, there is no such broad "twilight zone" between the men who are certainly members of the profession and the men who as certainly are not. It is also true that no other profession has such a multitude of strong, well supported societies, both local and national, as has engineering. In most other professions, the local society is the active and influential organization and the national organization is comparatively unimportant.

Take, for example, the legal profession. The really influential and active organizations are the county or city Bar Associations. The members of these associations know each other personally. They can hold frequent meetings without difficulty and pass intelligently on any question presented. The state bar associations on the other hand hold meetings perhaps once a year which only a few can attend. Where a state association attempts to act through committees on important matters the members are often separated by great distance so that meetings are difficult.

A notable illustration of the great advantage of the local society over a state or national society in securing prompt and intelligent action is recorded in the proceedings of the New York State Bar Association for 1918. The Committee on Legal Ethics reported that the similar committee of the New York County Bar Association had functioned so effectively in answering inquiries on professional conduct that the work of the committees of both the State and National bar associations on this subject might well be turned over to it.

In the medical profession, again, the strong and active organizations are the local organizations. It is these which deal with the important questions of ethics, discipline and compensation. The national organization —the American Medical Association—has as its members the members of its constituent state and territorial associations. The business of the national society is transacted by a house of delegates chosen by the constituent societies. This body meets once a year and the business of the association is carried on by a Board of Trustees then elected.

An illustration still closer to the engineering profession is furnished by the American Institute of Architects. This institute is an association organized locally into chapters and the chapter members are also members of the institute. The institute's business is carried on by delegates elected by the various chapters who meet in annual convention. Members who are not delegates may attend the convention but without power to vote.

Thus in the medical, the legal and the architectural professions the national organization has direct relations with the state or local organizations; and the national and state organizations function only in matters where united action is necessary, leaving most of the "welfare" work to the local societies.

ORGANIZATION IMPORTANT FOR WELFARE WORK

It may be well to explain why the form of organization in engineering is specially important if the profession seriously intends to undertake welfare work. So long as a profession continues along the old lines of merely reading technical papers and publishing transactions, it makes little difference how it is organized. Society work through committees, etc., is done when the members have leisure or else it is not done at all and no one complains very much.

Suppose, however, that it is decided by the engineering profession to take up and act upon some vital current matter such as the pay of engineers, or state control of municipal work, or water-power development. At once there develops such sharp conflict of opinion that a vote is necessary to determine where the majority opinion of the profession lies. Further, if these subjects are to be acted on and not merely discussed in an academic way, the members of a society must delegate their authority to some small group or committee or society officer who will act for them.

And this must be a "blanket" authority. Suppose for example that an engineering society commissioned a representative to work for a law in a state legislature relating to land drainage. That committee must have authority to use its discretion in handling the situation. The committee may find that certain facts, unknown to the engineers when they voted, will materially change the desirable form of the legislation. It may be better to take a half loaf than have no bread.

This is no new problem. Other professions and occupations have had to meet it and it is of interest to examine their solutions. A rather close parallel to the problem before the engineering profession is the situation which has been solved by the American Federation of Labor. Hundreds of independent labor unions of every sort and kind, often warring with each other where they overlapped, needed to exert a united influence in public affairs. The federation was the solution found. Its machinery is simple. Delegates are elected to an annual national convention from labor unions all over the country, in numbers proportionate to the membership in the union. The vote in the convention on a roll call may be cast with votes weighted according to the number of members each delegate represents. This convention elects an Executive Council of 11 members which carries on the business of the federation. The constitution prescribes as its duty, "to watch legislative measures in the interest of working people and to initiate, wherever necessary, such legislative action as the convention may direct." It also carries on a large-scale propaganda for the furtherance of the labor movement and acts as an arbitrator and peacemaker in controversies between different unions.

Another notable organization which was formed to secure the united action of a great number of existing societies formed for various ends is the United States Chamber of Commerce. The members of the chamber are the boards of trade, chambers of commerce and similar commercial or manufacturing associations in all parts of the country.

These local and other associations are represented in the United States Chamber by a number of delegates proportionate to the membership. These delegates are called together in an annual meeting and they there elect officers and a board of directors who carry on the business of the association.

A unique feature of the chamber is the circulation among its members of elaborate letter ballots for the expression of opinion on public questions. A ballot was recently circulated, for example, on the proposed Federal Department of Public Works.

The grave defect of the letter ballot as a means of testing the opinion of the membership is that very many of those to whom it goes have given no adequate attention to the subject discussed, and if they vote at all, will vote in ignorance and often with prejudice. To meet this objection, the ballots sent out by the United States Chamber of Commerce are always accompanied by a full statement of the question with arguments both for and against. It should be noted that the expense of this letter ballot system is such that only an association with a very large income could carry it on successfully.

There is provision for referendum votes also, in the constitution of the American Bar Association. The clause reads as follows:

> The Executive Committee are authorized to submit from time to time by referendum to the inidividual members of the association questions affecting the substance or administration of the Law, which in the opinion of the committee are of immediate practical importance to the whole country, and they shall order such a referendum whenever directed by the General Council.
>
> The Executive Committee may arrange with state and local associations for the extension of such referendum systems to the members of such associations.

A great deal of discussion has gone on among engineers respecting the lack of an accepted code of ethics and of means of enforcing such a code if adopted. It may well be doubted, however, whether notwithstanding its lack of a code, the ethical standards of the engineering profession are not at least as high as those of doctors or lawyers, or of any other professions whose internal discipline is oftenest held up as a model to engineers.

The ethical codes formally adopted by the legal profession are admirable in every respect; but the enforcement of these codes is well recognized to be practically impossible save where the infraction becomes so serious as to render the offender liable to prosecution and disbarment or more severe punishment.

It is of interest in this connection to refer to the report of the Committee on Grievances of the New York State Bar Association, made in 1918. The committee after reporting action in the case of certain complaints said,

> Unless funds are available for a retainer of a regular attorney for the Association similar to the arrangement made by the Bar Association of New York City and for the necessary expenses of taking testimony, the present machinery of the Association is wholly inadequate to deal with the situation should serious cases demanding prosecution arise.

The committee further declared that under existing conditions the expenses in connection with the discipline of members of the bar guilty of unprofessional conduct were a very heavy burden on individual members of the committee in charge of discipline, who were in no way involved, except as a matter of professional spirit or public duty.

In the medical profession, infractions of the profession's code of ethics which transgress also the statutes against crime are of course punished; but for minor departures from the code, the medical profession is no more accustomed to discipline its members than any other profession.

Where discipline is to be exercised, however, both these professions have the advantage of being able to act through their local associations and they avoid the almost insuperable difficulties which attend the discipline of members of a national society for unprofessional conduct.

FINANCES

Engineers are paying a heavier tax to support their professional societies than is paid by the members of any other profession. The annual dues of the national engineering societies are in most cases $15. In the American Society of Civil Engineers this is increased to $25 for members resident in or near New York City. Most engineers belong also to local engineering societies and pay annual dues averaging usually about $10. Many also belong to the American Association of Engineers where they pay annual dues of $15. It is generally agreed that the dues of the national engineering societies will have to be raised to cover the additional expense of welfare work. The American Association of Engineers needed more funds than its former $10 per year dues furnished and an increase to $15 per year was made recently.

It will be of interest now to see what are the society dues in other professions. In the legal profession, the annual dues of the American Bar Association are $6 per year; but only a small proportion of the lawyers of the country are members of this body. These annual dues include a subscription to the *American Bar Association Journal,* costing $1.50. The state bar associations are more important to the lawyer than the national association. The annual membership dues in the New York State Bar Association are $5. Dues in the local county and city associations vary of course but are generally low except where the association becomes a social club and expenses are correspondingly increased.

In the American Medical Association, the members are the members of the various local organizations which are represented in the association. The constitution provides that funds for the association "shall be raised by an equal assessment of not more than $10 annually on each of the members."

The American Institute of Architects has annual dues of $25 for fellows and $20 for members of ordinary grade. Dues for local chapter expenses are in addition to this.

The American Chemical Society has annual dues of $10 per year, and the members receive free the three regular publications of the society, costing more than half of this sum. Of these dues, a part is distributed to the local sections on the basis of 75 cents to $1.50 per member according to the size of the section.

The American Federation of Labor derives its financial support from the constituent members as follows:

> From International or National Trade Unions a per capita tax of seven-eighths of a cent per member per month. From local trade unions and Federal labor unions, 15 cents per member per month, of which 5 cents must be set aside for use only in case of strike or lockout. Local unions, the majority of whose members are under 18 years old, 2 cents per member per month. From Central and State bodies, $10 per year.

In contrast with these limited funds is the financial situation of the commercial organizations. The United States Chamber of Commerce is supported by dues paid by the local associations which are its members. These dues are approximately one-half of one per cent of the income of the local association from its membership fees. The minimum dues from a member association are $10 and the maximum $200.

In dealing with any business organization engineers are familiar with the fact that all the money expended merely to maintain the organization is an overhead expense which must be paid out of the operating receipts before profits can be determined. Professional and trade associations are not organized to earn profits; yet the same principle holds true—that the society must be judged by what it actually accomplishes in comparison with what it costs to carry it on.

Of course in certain societies which have social features, the contact established between the members is to be credited as part of the results achieved. There is a tendency, however, unconsciously to think of a society as somehow an end in itself, and to claim that the profession owes a duty of loyalty and service to it, apart from what it accomplishes.

This sort of loose thinking is doubtless responsible for a good deal of waste and misapplied energy in many professional societies. The engineer in charge of a business enterprise—if he is competent for his job—always applies to every proposed new expenditure the test, Will it pay? Will the returns received sufficiently exceed the cost of carrying it on to make it worth while? Exactly the same sort of test should be applied by the engineer to his expenditure on his numerous professional societies.

It is by no means intended by this to depreciate th importance to the engineering profession and to every other profession of its organizations. On the contrary, social and economic conditions at the present day make it imperative that engineers, like the men in every other occupation, should unite in efficient organizations to protect their common interests. Neither is it meant that engineering organizations should take any narrow view of their functions, and confine their work to things whose direct benefit to the profession can be estimated in dollars and cents, such as employment and compensation. On the contrary the great opportunity of the profession is to hear its present call to leadership, to undertake worth-while tasks and to create an *efficient* organization which can apply intelligence and ability to the successful peformance of these tasks.

Short Service of Untreated Piles at San Francisco

Piles of Piers in Sea Water Infested by Borers Last Only Few Months, or Few Years With Protective Paint

SHORT service records of untreated piles in the infested waters of San Francisco Bay, even when coated with protective paints, were noted in a report at the latest annual meeting of the American Wood Preservers Association. This information supplements the records of 18 to 29 years life for creosoted piles which were removed from Long Wharf on account of dismantling the structure and not on account of the condition of the piles, as described in *Engineering News-Record* of Aug. 21, 1919, p. 378, and in the above report.

It is stated by H. O. Demeritt, assistant engineer of the San Francisco-Oakland Terminal Railways, who has had charge of the trestle of the Key Route system since 1902, that the untreated piles driven in the Key Route structures in 1902 were replaced in 1906 and 1908, none of the old piling being removed. These later piles were of Douglas fir protected with paraffin paint between the mud line and high water. Many of the untreated piles driven in 1902 had already broken off and floated away by 1906, but the trestle was still supported at that time by the untreated piles, showing that they had a life of at least four years. The depth of water along the Key Route trestle varies from zero at the shore to 5 ft. at a distance of two miles out, and 12 ft. under the terminal, these depths being below mean lower low water. At the outer end of the terminal the depth increases rapidly to over 30 ft., which is the depth in the ferry slips.

Mr. Demeritt made a careful examination of the entire trestle piling in 1912. He found but little teredo action on the inner two miles, although the lomnoria had been very active in coning the piles off from high water to the mud line, the piles breaking off when about 2 in. of sound wood remained. Some of the piles in this section of the trestle lasted from eight to twelve years.

From the two-mile point to the end of the structure, both teredo and limnoria became more active. The piles broke off just above the mud line, and showed the uniform coning from high water to the mud line with the section near the point of breaking about 6 or 8 in. in diameter and completely honeycombed by the teredo. Most of the piles under the terminal showed about 18 ft. of surface exposed from high water to the mud line. but in the springline and fenders the exposed surface ran as high as 38 ft. These piles showed the same action of limnoria and teredo at 32 ft. below mean lower low water as was found on other piles at 12 ft. below.

Some of the 1908 piles protected with paraffin paint were found located where the mud had scoured away, leaving about 12 in. of unprotected green piling exposed at above 12 ft. below mean lower low water. This exposed area has been riddled by the teredo, but little limnoria action was found.

Thirty untreated and unprotected fir piles were driven in January, 1913, about 10 ft. south of the trestle, spaced about 50 ft. apart and used as pull-off anchor piles. In October it was necessary to replace all of these as they were completely riddled with teredo holes above the mud line. The new piles driven here were protected with Columbia paint only to mean low water. Between October, 1913, and October, 1918, these piles were completely destroyed by limnoria. A few teredo holes were also found.

In 1913, the protected piles driven in 1906 under the terminal began to fall out, and since that time all the protected piles have been replaced with creosoted piles. The failure of the protected piles, in Mr. Demeritt's opinion, was due to the action of mussels or shellfish in forcing off the outer strips of the protection and then the waves and tides would tear the burlap away, leaving the green wood exposed. The average life of these protected piles was about seven years.

Frank H. White, chief engineer of the California Board of State Harbor Commissioners, has accumulated data extending over a long period of years and convincing him that along the waterfront of San Francisco untreated piling cannot be depended upon to last more than nine to twelve months. Many piles examined by him have been completely riddled by teredo action after being in service one year. Destruction by limnoria is also very rapid, although piles on the San Francisco side of the bay opposite the former site of Long Wharf are rendered useless by teredo before being greatly weakened by limnoria.

Sodium Fluoride as a Wood Preservative

Tests made years ago at the Forest Products Laboratory indicated that sodium fluoride might be used successfully as a wood preservative, because it had high toxicity, was not injurious to metal, and was convenient to handle. In order to obtain comparative durability records, the laboratory in 1914 placed sap-pine ties treated with sodium fluoride, together with ties treated with zinc chloride and creosote, in one of the mines of the Tennessee Coal, Iron and Railway Co., at Birmingham, Ala. Similar service tests were also started at this time with red oak ties placed on the Baltimore & Ohio R.R. After five years' service the mine ties which were treated with sodium fluoride have been found in as good condition as those treated with zinc chloride, both showing very little deterioration. The creosoted mine ties apparently were in still better condition, while those untreated were in various advanced stages of decay. The red oak railway ties treated with sodium fluoride were practically all sound, as were those treated with zinc chloride, while a large percentage of the untreated oak ties had been removed. These tests, as well as others started later, must continue for a number of years, according to the views of laboratory investigators, before the relative value of the sodium-fluoride treatment for ties and timbers is known.

Crossover Practice

An Argument on the Issues of the Pittsburgh Bridge Case

Through the clashing opinions on the Pittsburgh bridge case expressed by the Board of Direction of the American Society of Civil Engineers on the one hand and a joint committee of the American Institute of Architects and the Engineering Council on the other, there has been created a sharply marked division of attitude toward questions considered vital to efficiency in engineering practice. In contributing a discussion of some of the issues, Mr. Shenehon speaks for one of the parties. He was a member of the joint committee of three architects and three engineers, and functioned as chairman of the committee.

Mr. Shenehon's views here expressed are remarkably original. They rest on two bases: First, the assumption that architects are engineers, in other words that architecture constitutes a specialty of the large field of engineering. Second, a belief in the desirability of expansion of what he terms crossover practice—apparently even when this becomes mere brokerage.—Editor.

By Francis C. Shenehon
Hydraulic Engineer, Minneapolis

THE profession of engineering tends like other professions to specialization, and we think of ourselves as bridge engineers, railroad engineers, sanitary engineers, hydraulic engineers, electrical engineers, mechanical engineers, mining engineers, structural engineers, and architects.

Each of these specialties may be regarded as a branch of a single great technical trunk which contains all that is basic in the theoretical part of the profession. Perhaps most engineers are general practitioners spanning several specialties, and the specialists themselves are so nearly akin that a certain *crossover* is always likely to take place. The question now arises as to the desirable limitations which will keep each man fixed in his proper groove as the shoemaker sticks to his last. Must the bridge engineer eternally build bridges and nothing else? Shall the electrical engineer draw an insulated circle about himself and never reach outside of his energized area? Does the mining engineer keep his practice strictly within his geological zones? Does any engineer of wide practice wish to work for a prohibition law which will keep him out of any field which appears to him somehow related to his pivotal specialty?

Let it be understood that the writer specializes in hydraulic engineering and has viewed without resentment engineers of other breeds invading his field. As instances:—an eminent bridge specialist designed balanced ship locks for an Erie-Ontario canal; a specialist in bridges and buildings designed a dam, with all the complex hydraulic subtleties which this involved; an electrical engineer developed a water power. In the condemnation of the water power at the outlet of Lake Superior, a mining engineer was the writer's fellow-expert.

Here are some crossover cases: A railroad engineer acts in his function of chief in much bridge engineering. An engineer of Minneapolis has designed a million dollar apartment building. Architects designed a great power house at Niagara Falls. Engineers built the Washington Monument in the national capital.

In medicine a man is generally licensed to practice over the whole broad field. If he elects to become a specialist for the eye, ear and throat, an additional license is seldom required; and he may still serve as physician in a case of typhoid fever. There is seldom any reason in the law why a general practitioner in medicine shall not remove a cataract from the eye of any of his patients. The man who specializes in children's diseases may also serve as an alienist. A diagnostician may operate for goiter or mastoid.

In the legal profession admission to the bar admits to general practice and reaches into any specialty in which a lawyer may wish to enter. A real estate lawyer may defend a murderer and a criminal lawyer may try an involved insurance case. A corporation lawyer may serve in riparian disputes. A specialist in insurance may try an admiralty case.

It is reasonably certain that engineers do not wish any statute law to imprison them in a limited specialty. Perhaps it is equally certain that a great vital principle of professional righteousness is recognized, which does deter each high-minded engineer or architect from undertaking service in fields in which he is not master, or in fields in which his *associates* are not masters. While the chief engineer of a railroad may not be a bridge engineer, his associates are bridge engineers; while the chief engineer of the Chicago Drainage Canal emerged from railroad engineering, his associates were hydraulic and sanitary engineers; while an architect may not be a master in difficult foundations or in intricate structural steel work, his associates are masters; while a structural engineer may have vague conceptions of esthetic values his associate architect supplies these; and while an architect might go astray in the design of a steel arch bridge his associates, if wisely chosen, will secure sound, safe, economical results.

In the end the truth must emerge out of this interlocking of specialties which characterizes most great structural achievements, that master builders are doing teamwork for the best results; and the decision as to who shall be chief is concerned more with administrative capacity and professional grasp, than with the peculiar specialty of the able engineer or architect who is selected to direct the enterprise. After all, "Where MacGregor sits is the head of the table."

The writer, as chairman of the Council committee of engineers and architects to which was referred the Pittsburgh bridge matter, feels a seventeen per cent responsibility for the judicial finding of this broad principle:

> *Where a structure, whether bridge or building, embodies work which extends into two fields, a specialist in either field may be chief and the other associate.*

Following this principle an engineer may direct the design and erection of a cathedral, and an architect may direct the design and erection of a steel arch bridge. It is very certain that this principle justifies the structural engineer whose practise already covers wide fields in which architects long exercised sovereignty; and engineers must not feel too deeply aggrieved at the reciprocal privileges accorded the architect. It is conceivable that a big, able architect might achieve better results than a little incompetent bridge engineer. The basis of judgment in the assignment of work is more likely to rest on ability than on specialty.

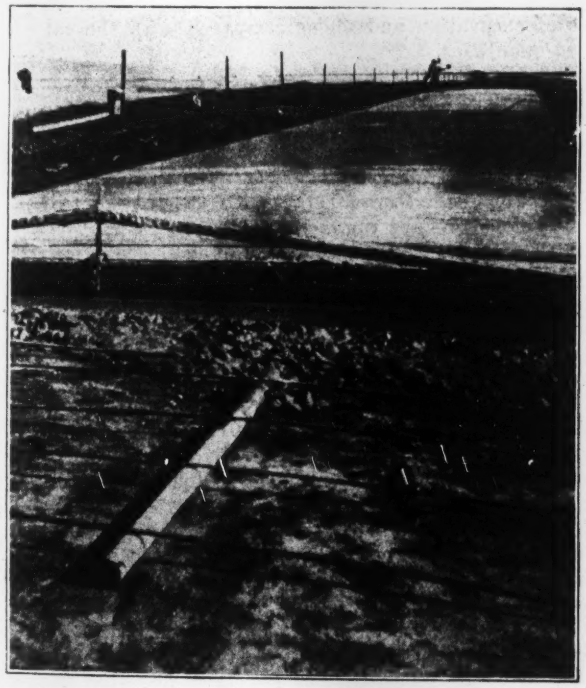
Reinforcing Concrete Pavements on California Highways

Transverse Bars Used to Prevent Cracks from Widening and to Maintain Surface Continuity

THE use of reinforcing in concrete pavements is favored by the California Highway Commission. Experiments have been under way for some time and a total of about 40 mi. of paving has been laid in which reinforcing bars were used. Although the studies are not yet completed, A. B. Fletcher, chief engineer of the commission, states that if ample funds were available for Cailfornia's highway program he would recommend the use of steel bars in all concrete paving laid by the state.

The basis on which has been decided the question of what reinforcing to use is that it is impracticable and unnecessary to reinforce pavement for beam action, as in the case of a floor slab. It is impossible to determine to just what extent the pavement will act as a slab, and, therefore, the amount of steel required to enable the slab to carry its load without cracking cannot be calculated. But the cracking in itself is not considered serious. Transverse cracks which are not ordinarily followed by any loss of continuity of surface are regarded as nothing worse than unsightly. If longitudinal cracks could be kept in the same category, it was reasoned, the steel would be serving its purpose. After some experiment based on this reasoning, the preferred plan is to use ⅜-in. twisted bars placed transversely on 18-in. centers. Assuming that longitudinal cracks would occur, this size and spacing was found to meet most nearly the requirement of maximum bond across such cracks for the minimum outlay in steel.

In recent work an improvement has been made, it is believed, by the addition of a longitudinal run of ⅜-in. bars along each edge of the pavement. Where paving has to be as narrow as the 15-ft. widths now being laid in California, the shoulders are soon worn down and at the point where transverse cracks reach the edge, triangular sections are liable to ravel out. The longitudinal bar along the edge materially strengthens these weak points. For convenience in ordering and handling, the longitudinal bars are used in same size and lengths as those laid transversely. They are laid with joints alternately butted and lapped, care being taken to bring butt joints half way between adjacent transverse bars. Thus a transverse crack in the paving can occur every 30 ft., which has been found to be the average, without crossing steel. By making the break in the longitudinal steel midway between a pair of transverse bars there is less likelihood of the transverse crack following one of the bars it parallels.



PIPE SUPPORTS REINFORCING BARS UNTIL CONCRETE IS POURED

Both corrugated and twisted steel bars have been tried. The first to be put down were ½-in. bars on 2-ft. centers. Later ¼-in. bars on 12-in. centers were tried. Partly because the latter were too flexible a change was made to ⅜-in. bars which were spaced on 18-in. centers. This arrangement worked well and no reasons that would warrant a change have as yet appeared.

In all cases the bars are put in the center of the slab as near as practicable. Several ways have been tried for getting the steel into place in the freshly poured concrete. For example, they have been thrust down from the top, pulled up from the bottom where they were laid before the pouring, or they were placed on stones which were laid on the surface before pouring, or a layer of about half the paving thickness was spread first and the steel placed on top, after which the remainder of the slab was poured. The methods now used vary on different jobs, but the preferred plan is to place the steel on the ground and after the concrete has been poured over it, pull the bars up into place with hooks.

Triangular mesh reinforcing has also been tried but it has been comparatively hard to handle, costs more and there was some question as to whether it would make the most effective use of the steel, under the theory that the primary function of the reinforcing is to provide a bond across the longitudinal cracks. On a 15-ft. paved strip, triangular mesh of weight equivalent to that of the ⅜-in. bars, costs $1,750 per mile, The ⅜-in. transverse bars on 18-in. centers cost $1,470 per mile, and the use of runs along each edge adds to this $300 per mile. These figures, made up some time ago, are on the basis of reinforcing steel at 5c. per pound, delivered. The cost for placing the steel bars and all expense incident thereto was 1c. per pound, and for the triangular mesh 50c. per 100 sq.ft.

Ban Put on London Building

According to a recent issue of *Commerce Reports* the London County Council has served notice on a number of firms ordering work to cease on their premises in respect to rebuilding or alterations. Among the firms receiving such notice are some of the largest department stores. Such action is said to have been taken under the provision in the Housing (Additional Powers) Act, 1919, authorizing a stoppage of "any building contemplated or in course of construction which may cause a shortage of labor or material for the provision of dwelling accommodations."

Shrinkage of Loosely Filled Earthwork in Embankments

Distinction Between Shrinkage and Reduction in Volume — Varied Opinions and Few Reliable Records Indicate Need of Study and Experiment

By E. E. R. Tratman
Associate Editor, *Engineering News-Record*

DOES earthwork in fills built by dumping shrink to a volume materially less than that which it occupied before excavation? What is the relation of the volume of an old fill to that of the original cut from which the material was obtained? These are matters of long controversy in connection with railway construction and more recently in regard to valuation. They enter also into highway construction, although specifications for such work sometimes provide for building fills in layers compacted by rolling. They do not apply to dams and reservoir embankments, in which special methods are employed to consolidate the material as it is deposited.

It is general opinion that shrinkage does exist, but a wide range of allowance indicates lack of agreement or authority as to the extent of shrinkage; absence of a uniform basis of comparison clouds the reliability of figures given; allowances in many cases are based on general observations or published data of doubtful value; analysis of various causes or phases of shrinkage is lacking, and there is a scarcity of reliable experimental data.

Close Determination Needed

It has been argued that an engineer needs only to know whether fills are of less volume than indicated by the original excavation. That position cannot be sustained. It would be as though he should hold it sufficient to know that a bridge weakens with age, and should not trouble to consider or study the various and relative effects of corrosion, wear, vibration, increased loading and design details. The question of shrinkage of earth, as a scientific proposition and a practical condition, should be capable of fairly close determination, but very little has been done in this direction. The question of comparative volume of an existing fill and the excavation which furnished the material is likely to involve extended periods of time and indeterminate conditions which prevent any but very approximate conclusions.

Present practice in making allowances for shrinkage appears to be based largely upon the results of limited experiments made about 1840 by Ellwood Morris and reported by him in the *Journal of the Franklin Institute*, 1841, page 235. For three embankments, aggregating over 43,000 cu.yd., he showed an average compression of 10 per cent in volume and deduced allowances of one-eighth of the volume in excavation for light sandy soil, one-tenth for yellow clayey earth and one-twelfth for gravelly earth. But there is little information as to the conditions or the accuracy of these experiments.

That shrinkage of excavated material to less than its original volume when placed in embankments is a negligible quantity and is to be excluded as a factor in railway valuation is the conclusion of a report made in 1919 by the Illinois Public Utilities Commission. This decision reopened the controversy, as in railway valuation shrinkage has been accepted as an element affecting the quantities to be allowed.

A statement by an engineer member of the commission is as follows: "If the quantities were determined by a true cross-section of the embankments as they now exist, in most cases they would be compatible with the solid contents that were placed originally, as measured at that time from material taken from cuts and borrow pits and for which the contractor was actually paid." This statement appears to overlook the influences of ditching and widening and erosion which occur during years of railway operation. The commission's conclusion is given in the following words:

"Shrinkage of earthwork has not been found to exist generally. Shrinkage may take place in certain special cases, but the quantities involved in such cases are practically negligible. Before any allowance of shrinkage shall be made by this commission, such shrinkage must be established by sufficient experimental data to show conclusively not only its existence, but its amount in the various soils when placed under unusual conditions."

The Illinois commission was not the first to assert that there is no actual shrinkage of volume in fills. The same position was taken by Prelini several years ago in his book on "Earth and Rock Excavation." It was expressed also by S. P. Baird in an article in *Engineering News* of Nov. 2, 1916, p. 850. On the basis of his own tests and observations, the latter attributed the apparent shrinkage partly to subsidence of the ground beneath the fill and partly to variations in actual yardage of excavation and fill as compared with the calculated quantities.

Doubt as to Shrinkage

From an extended inquiry and a survey of the field it appears that in answer to the question at the head of this article a majority of engineers will say that the fact of shrinkage is well established and that its extent is sufficient to have an appreciable effect upon earthwork quantities and estimates. But some will express doubt and a few will go so far as to say that any actual shrinkage is so slight as to be negligible. A brief study of individual opinions and of technical literature is sufficient to show confusion and uncertainty as to this factor in earthwork construction.

The shrinkage problem has been the subject of discussion among engineers, in technical journals and before engineering societies for over 30 years, but it remains unsettled and is not even stated on a uniform or definite basis. Two principal reasons for indefiniteness and discrepancies are lack of a universally accepted meaning of the term "shrinkage" and lack of experimental data of sufficient extent or authority to warrant definite conclusions.

In the first place there are two distinct systems of basing shrinkage. One is the relation of volume of a fresh or green fill to that of the same fill after settlement. The other is the relation of volume of a cut, borrow pit or other original excavation to that of the settled fill made from such excavation. Obviously, these are quite distinct and are not comparable, but in discussions and published information it is not always indicated which basis is employed. Both are important, but they must be considered separately. As to the first there can be little difference of opinion, except in regard to the amount, for loose material (whether earth or rock) freshly placed in a fill will surely settle or consolidate in time and thus shrink to a smaller volume. In Prelini's "Earth and Rock Excavation" the volume of the green fill is advocated as the basis for shrinkage determinations, but this excludes comparison of excavation and fill.

WHAT IS MEANT BY SHRINKAGE?

Even with the volume of original excavation as a basis, shrinkage has two different meanings. It is sometimes taken to mean the actual consolidation of a given mass of loose material. In other words, taking a block of a hundred cubic yards of solid undisturbed ground, what volume will this same measured material have when deposited in place and after allowing time for the consolidation of its particles? On the other hand, shrinkage is taken to mean the difference between volume of existing fill and of original excavation, including not only the shrinkage proper (as above) but also such variable factors as loss in transportation, loss by erosion and apparent loss due to subsidence of subsoil and to inexactness of measurements made at widely separated times.

In illustration of the diversity of opinion as to the extent of shrinkage, the roadway committee of the American Railway Engineering Association found shrinkage allowances ranging as follows: In filling from trestles, 7 to 30 per cent for black dirt, 5 to 30 per cent for clay and 3 to 15 per cent for sand. The committee's recommendations were 15, 10 and 6 per cent respectively. In raising fills under traffic, the allowances ranged from 4 to 20 per cent for black dirt, 2 to 20 per cent for clay and 2 to 15 per cent for sand. The committee recommended 5 per cent in each case. Evidently the range is far too great to be accounted for by variations in local conditions.

This committee pointed out that while it has been general to allow 10 per cent increase in height for shrinkage in fills up to 25 ft. high and 15 per cent for those over 25 ft., "it would appear foolish to follow such a rule by making a 100-ft. fill 115 ft. high, the chances being that it would be necessary to lower the grade before laying track." It stated, however, that it is good practice to allow 10 per cent in height but to limit the increase in height to 5 ft. as a maximum, this being for a 50-ft. fill. On the other hand, shrinkage allowance in width was stated to be preferable, with an increase of 10, 15, 20 and 25 per cent for banks having a normal top width of 25, 50, 75 and 100 ft. respectively.

In its report of 1917, this committee stated that it is easier to increase the height than to lower it after track has been laid, and recommended that the width be increased from 5 to 20 per cent, depending upon material and conditions. For fills of 50 ft. and over the committee considered that there should be no increase in height, except at the shoulders to provide material for raising the subgrade after settlement. Thus, if the anticipated shrinkage is 7, 10 or 15 per cent there should be added 10, 15 or 22½ per cent respectively to the height of each shoulder.

Conclusions based on investigations by the Division of Valuation of the Interstate Commerce Commission are as follows: A cubic yard of earth measured in excavation will occupy less space when measured in compacted embankment. The height of embankment appears to have little effect on its subsequent shrinkage. The ordinary allowance for shrinkage of earth embankment is from 8 to 12 per cent, with an average of 10 per cent. These conclusions are held not to apply in the case of gumbo, hardpan, cemented gravel or materials taken from the beds of streams or from overflowed river valleys, as such materials ordinarily are dense, and the shrinkage, if any, can be determined only by actual measurements. A rule issued by the engineering section of the Division of Valuation in 1918 specifies a shrinkage allowance of 10 per cent. This figure as an average is used very widely by engineers, but recent investigation by the engineering committee of the Railway Presidents' Conference Committee, in regard to valuation, indicates that this is a minimum and that 14.4 per cent is a more correct average figure.

According to one explanation of shrinkage: "Material taken from a cut and placed in an embankment will show an increase or swelling at first because of the loosening of the particles and the consequent increase in voids, but ultimately these particles will be compacted by weight, vibration, the action of the elements and other causes until they occupy less space than they did originally." There is no dispute over the first part of this statement, regarding the initial swell of volume. But there is dispute over the second part, as to whether the ultimate shrinkage (exclusive of outside losses) will give a volume less than the original. For instance, Prelini's book, already noted, states: "The mistaken belief that earth in fill will shrink to less than the volume measured in the pit originated in the foolish manner of measuring by counting the number of cart loads, the capacity of the carts having been measured."

FACTORS WHICH AFFECT SHRINKAGE

Three combined causes have been suggested for embankments requiring more material than is called for by the theoretical cross-sections. In the first place, the theoretical section is usually exceeded, since materials which flow freely will overrun the slope stakes and exceed the base width if the crown is finished to full width; with materials which do not flow freely, the crown must exceed the normal width if the full base width is to be reached. In the second place, there is shrinkage or solidification of the material itself, which may continue through a series of years. In the third place, there is subsidence of the natural ground on which the bank is placed. This last, in Prelini's opinion, is accountable for a very large apparent loss of material and is not given sufficient consideration in comparing quantities.

Much of the discussion and the published matter of earthwork gives evidence of confusion as to shrinkage proper and shrinkage plus various losses during and after construction. It might appear at first sight that the shrinkage on the basis of volume prior to excavation could be determined readily by experiment or by measuring of cuts and fills. As a matter of fact, determination of either method is difficult, owing to the variety of factors which affect the problem.

Time is a factor of prime importance, though frequently neglected. A cubic yard of solid material may make more than a yard of fill when excavated and placed, but settlement will begin at once and will be affected by the weather and material, and by the loading and vibration in a fill carrying traffic. What time should be allowed before measurement for shrinkage is made? Should the time be the same for all materials? What time should be allowed to elapse before the fill is considered to have taken its final set or settlement? According to Gillette's "Earthwork" the settlement occurs mainly during the first year, but some engineers consider that it continues for several years. In valuation, the time (that is, the age of fill) may have a very wide range.

The character of the material is important, since it may be light or heavy, loose or lumpy, dry or sticky. The different grades of any one material also enter into consideration. Moisture content is a factor, which in turn is influenced by atmospheric conditions. Frozen material will cause heavy shrinkage and should be avoided. Varying percentages of shrinkage have been given for different kinds of material, but it is more general to allow an average figure for all "common excavation." In fact, some engineers state that they doubt whether present knowledge warrants specific allowances for different materials. Large fills are composed usually of a variety of materials, and aggregates of measurements of fills or long stretches of line are influenced by this same condition.

Surface material consisting of loose soil has been claimed to compact in fills much more than the dense and hard materials 15 to 20 ft. below the surface. Consequently, a railway having a large proportion of shallow cuts and fills might show a higher shrinkage in proportion to its yardage than another railway in the same territory but having deeper cuts in denser subsurface material. This cannot be accepted for general application without further study. Valuation figures on 600 miles of line in the ordinary earth materials of the Central States showed a range of from 6 to 18 per cent for shrinkage in the lighter grading of 6,600 to 15,000 cubic yards per mile and 7 to 14 per cent where the grading ran 26,500 to 35,000 yards per mile. The work covered fills from six to thirty-six years old and necessarily included the factor of loss by erosion and other causes.

CONSTRUCTION AS A FACTOR

The method of building the fill is another consideration, for it is reasonable to expect a difference in the behavior of material which is deposited in such diverse ways as the following: (1) placed by scraper or dump wagons and thus somewhat compacted by wheels and hoofs; (2) dumped from cars on a surface track and then spread; (3) dumped loosely over the side slopes; (4) dumped vertically from a construction trestle. Rolling railway fills in horizontal layers has been advocated in order to increase their stability and permanence, but the use of this practice has been very limited.

One recent example of shrinkage study is that of sand filled nearly 40 ft. deep between concrete walls and provided with drainage. To obtain maximum shrinkage within the shortest time, so as to avoid additional filling to maintain the grade after the line had been opened for traffic, the fills were flooded with water for about ten days. The settlement approximated 10 per cent. In ordinary fills of similar material this figure is from 7.5 to 9 per cent.

Waste or spilling of material in transportation from cut to fill, subsidence of the subsoil and erosion of slopes by wind and rain may reduce the volume of fill and increase the apparent shrinkage. The first of these losses appears to have been given little attention and no figures or allowances are available. It cannot be assumed that every cubic yard of excavation goes into the fill, and the intermediate loss may nullify comparison between the volumes of cut and fill.

In Prelini's book it is stated that while engineers have shown by comparative measurements that the volume of fills is smaller than that of the earth in its natural bed, they are mistaken in attributing this to shrinkage. In his opinion the decrease in volume is due to the fact that some of the earth removed has been lost in transportation to the fill and that much more is washed away by rain during the construction of the fill. To determine these losses in such a way as to obtain a result universally applicable is impossible in his opinion, owing to the variable local conditions of weather, length of haul, method of transportation, and the tightness of the cars or other means of transportation.

SUBSIDENCE AND EROSION

As to subsidence of subsoil there is again great difference of opinion. A fill cannot be assumed to rest upon an incompressible base, except in the rare event of solid rock, but the extent of subsidence will depend upon the character of the subsoil and the height and weight of fill. Some engineers consider that this factor is so slight that it may be disregarded and others consider that whether large or small there is no reason to separate it from shrinkage.

It is more generally considered, however, that this is a large factor which has been given insufficient consideration. In fact, as the result of extensive study by measurements and borings, one engineer concludes that the loss due to subsidence or compression of the subsoil is enormous. Swampy ground will show the highest loss of this kind, but even on firm sandy loam, a subsidence of more than a foot has been found over the entire base area of 40-ft. fills deposited from trestles.

That subsidence represents a very definite loss is stated in the 1920 report of the roadway committee of the American Railway Engineering Association. Investigation on several hundred miles of line indicates that it exists under practically all embankments and should be considered when revaluation surveys are being made. It is held that subsidence averages 1 per cent per foot of height of fill, giving 10 per cent of original volume in a 10-ft. fill.

Erosion of cuts, fills and borrow pits will begin as soon as the work begins, its extent depending largely upon atmospheric conditions. An engineer in charge of extensive valuation expresses the opinion that erosion by rain does not entirely remove much of the embankment, but simply transfers a wedge of material from the top of the slope to the bottom. He believes that the amount can be ascertained readily by comparing the present and original angles of the slope. It seems that such a method could give results which are only approximate and which would not permit close determination of volume of the fill. Erosion may be eliminated by sodding the slopes, while as a rule it will decrease on old slopes owing to the formation of a protecting crust or the natural but irregular growth of vegetation.

In any comparison between the original volume of cut and the present volume of fill made from that cut, possible discrepancies in measurement must be taken into account. These may be due to inexactness of calculations and measurements, or to the use of different methods in the original and subsequent measurements. It must be remembered also that actual cuts and fills do not follow theoretical cross-sections, but are more or less irregular in slope and shape.

SUPPLEMENTARY WORK ON FILLS

Another very important point to be considered is that cuts and fills after a few years are by no means directly comparable with their original conditions. This is evident when it is understood that during these years there has been more or less ditching and cleaning or widening of cuts, widening of fills with material obtained from these cuts and from other sources, raising of fills by new material to maintain the grade, and slipping or caving of slopes of both cuts and fills. It appears impracticable to determine the amount or relation of the variations introduced by such factors.

In a study of original and present volume with regard to grading contracts, it was found that no definite results were obtainable. Fills had been raised without record of the amount of source of material, borrow pits were not preserved, and the quantities removed from adjacent cuts by ditching were not on record. An engineer who has been trying for some years to obtain evidence on earthwork shrinkage states that in every case the complications were such as to render it impossible to arrive at conclusions. Further, to eliminate the uncertainty due to such supplementary work extended study has been made of lines where grading had been commenced or completed and then abandoned. The results indicated an average loss of at least 10 per cent for shrinkage, erosion and other factors. Most engineers will agree that exact or reliable comparison of volume in old cuts and fills is almost impossible owing to the absence of adequate records of work done upon them since their original construction.

TESTS AND PUBLISHED DATA

Coming now to the question of published records of earthwork investigations, it appears that these are limited and of doubtful authority. Many engineers of wide experience in construction admit that they have never had occasion to make careful measurements of earthwork shrinkage, but have adopted allowances used by others or set forth in technical publications. In itself this is unimportant, since it is natural that the many should rely upon the results of study by the few. The importance of the statement lies in the limited extent and inadequate records of the experiments on which such allowances are based.

That shrinkage is an important element in earthwork construction is stated almost unanimously in technical books, but the basis for the assumption is indefinite. Prelini's book takes the view that shrinkage does not occur, but fails to give evidence in support of that view. In connection with the report of the Illinois commission, already mentioned, its engineers endeavored to trace the basis of published statements as well as of the general assumption that earth in well-settled fills will have a volume less than that which it possessed prior to being excavated.

It appeared that in many cases the statements and opinions were founded directly or indirectly upon the limited experiments made about 1840 by Ellwood Morris, as stated in the opening part of this article. According to these engineers, the conclusions presented by Morris some eighty years ago have been accepted and repeated by different writers from time to time without verification or checking. Furthermore, while this recent investigation included a search of published information and an inquiry of numerous authorities, it did not bring to light any modern experiments or tests of shrinkage.

BEHAVIOR OF ROCK FILLS

Rock fills may be considered briefly, though they differ from earth fills essentially in that they show a permanent increase of volume as compared with the original excavation. This is due to the large volume of voids in rock blasted from the solid and to the relatively small settlement or consolidation of the material in the fill. The increase or swelling depends largely upon the kind of rock and the size of the fragments.

Even rock will show a shrinkage when the volume of settled fill is compared with that of the green fill. For this one engineer make an allowance of 20 per cent for loose rock and 30 per cent for rock blasted from the solid. In other words, the volume of settled rock fill may be 15 to 40 per cent greater than the original volume of solid rock and 20 to 30 per cent less than the volume of the fresh fill. The shrinkage allowance will be higher also for soft or friable rock than for hard rock.

CONCLUSIONS

As a general conclusion it may be said that reduction of volume of an old fill from the apparent volume of original excavation is fairly well established by experience and investigation. But what proportion of this reduction is due to actual shrinkage of the material in place cannot be stated, for it is evident that a considerable but varying and perhaps indeterminate proportion is due to numerous extraneous losses. Further, this reduction in volume necessitates the addition of material to the fill from time to time, but there may be no record of the quantities excavated or placed in this supplementary work. Again, comparisons of old and new measurements are likely to be affected to an unknown degree by the lack of close accuracy and lack of uniformity in methods of measurement.

It is unfortunate that much of the evidence on shrinkage proper (as distinct from total reduction in volume) is based upon general opinion and observation, or upon old and limited experiments which may not apply to present conditions. There appears to be little in the way of modern scientific investigation to throw light on the subject. Laboratory tests will show the compressive properties of different kinds of material under different conditions. But their results will serve only for general guidance, since an embankment may contain several kinds of material and several grades of any one material, the positions and proportions of which cannot be determined.

For definite conclusions as to shrinkage proper it appears that action should be initiated along two closely related lines of investigation. First, there must be discussion and decision as to just what conditions are to be considered and what results are to be sought. Second, having reached this decision, it will be necessary to conduct such experimental work and observations (both in the laboratory and the field) as to produce results which will permit of definite conclusions being formulated.

A supplementary conclusion, based upon the evidence of extensive work involved in maintaining fills at normal elevation and section, is that railways might well consider construction methods which will produce fills of greater solidity and permanence, even at greater first cost.

Railway Wages and Labor Efficiency

INCREASED COST and decreased efficiency of railway labor was the subject of an address delivered recently at Philadelphia by Elisha Lee, vice-president of the Pennsylvania R.R. System, who pointed out that a traffic increase of only 18 per cent for 1919 as compared with 1915 required 31 per cent more men and 129 per cent more wages. Causes for this lessened output in spite of higher wages he attributed to the following causes:

"The general lowering of the sense of personal responsibility, which unfortunately, seems inseparable from working for the Government. Loss of many of our best men in the war, some temporarily, others permanently. Establishment of the eight-hour day, inauguration of a rigid seniority rule regarding promotions and layoffs, regardless of differences in individual ability. Abolition of piece-work in the shops. Diminution of the disciplinary powers of officers, brought about by the sanctioning of appeals to Washington over decisions of officers on the spot."

Wages for track labor have increased from $1.75 per day before the war to $4.50 per day, but records of work show that the efficiency of the men has decreased 40 per cent, according to Mr. Lee. Careful study during the five years 1914-1918 as to amount of track material applied, number of men and number of hours showed that at the end of the period wages per man per hour had been doubled but that twice as many men were required. In other words, a unit of track work that cost $1 in 1914 cost $4 in 1918. There was an improvement in 1919, however, the figures for the first six months showing that the $4 figure had been reduced to $2.65. Mr. Lee expressed the opinion that this improved condition wil continue.

Activated-Sludge Plant at California State Prison

For the past two years an activated-sludge plant has been in operation at the California State Prison at Folsom. Ralph Hilscher, director, Bureau of Sanitary Engineering, California State Board of Health, Berkeley, Cal., states that the Folsom plant serves a population of about 1,500 and appears to beg iving excellent results, although operated by convict labor—"that is notoriously unreliable." The air diffusion at Folsom is by means of perforated pipe which Mr. Hilscher says he understands has given almost no trouble. Mr. Hilscher states that this is the only activated-sludge plant in operation in California, the one projected by the city of Hermosa Beach (see *Engineering News-Record*, Nov. 9, 1916, p. 890) never having been constructed.

Freight Rates and the Railway Problem

THAT an increase in freight rates is absolutely necessary to enable the railways to operate and give adequate service was emphasized in an address delivered recently before the Chicago Association of Commerce by Daniel Willard, president of the Baltimore & Ohio R.R.

In the year ending Oct. 31, 1919, the operating expenses of the Eastern railways were 88 per cent of the gross earnings, said Mr. Willard, and if present wages and prices of materials had been in effect the expenses would have absorbed nearly all the earnings. For the decade previous to the war, the operating ratio on these railways was about 68 per cent and in 1917 it was 74 per cent. Assuming that 75 per cent should be the maximum and that there should be a net income of 25 per cent to apply for capital purposes and other obligations, then on the basis of last year's business the Eastern railways would require an increased income of $544,000,000. If the Interstate Commerce Commission should grant the request for rates yielding 6 per cent upon the book investment account of the railways, this would produce about $550,000,000. In Mr. Willard's opinion this investment account fairly represents the aggregate value of the railways.

The higher rates proposed will not be a burden on business interests, said Mr. Willard. They will be lower than those of any other country and relatively lower than the earlier "low" rates owing to the high prices which now prevail. It has been stated by Mr. Prouty, of the Interstate Commerce Commission, that in order to make private operation a success the railways should secure rates "which are too high rather than too low." In Mr. Willard's opinion the rates asked by the eastern railways are not too high and may be too low.

Improvements, additional facilities and new equipment require an average annual expenditure of $1,000,000,000 by the railways. But for the past ten years these expenditures have averaged only $600,000,000 annually, according to Mr. Willard, and owing to the limited purchases of equipment during the period of Federal control the railways have a shortage of about 2,000 locomotives, 100,000 freight cars and 4,500 passenger cars. The revolving fund of $300,000,000 provided by Congress is not more than half the amount needed for new equipment, to say nothing of improvements and additional facilities. To obtain the needed new capital of $1,000,000,000 annually, well established credit is necessary, and in Mr. Willard's opinion this will be effected by the Transportation Act.

Another aspect of the rate question is shown by Prof. Moulton in *Chicago Commerce* for May 22. He states that while the public may have to pay the bill for increased rates through higher prices of commodities, there is a limit to the prices which the public will pay. If this limit is exceeded the market breaks owing to declining demands. If people refuse to buy goods in the usual quantities owing to increased prices, the railway may suffer through reduction in volume of traffic offsetting the advantages due to higher rates. Mr. Moulton admits that there appears to be no alternative for higher rates, but points out the critical condition of the railway problem and the entire industrial problem. He expresses the hope that the principle of wage reduction coincident with falling prices will be incorporated in the pending wage settlement.

New Code of Ethics for Mechanical Engineers

AT ITS meeting in St. Louis May 24-27 the American Society of Mechanical Engineers approved the following code of ethics submitted by a committee consisting of Robert Sibley, John B. Martens, H. J. Hinchey, Charles T. Main and A. G. Christie:

1. The mechanical engineer should be guided in all his relations by the highest principles of honor, of fidelity to his client, and of loyalty to his country.

2. His first duty is to serve the public with his specialized skill. In promoting the welfare of society as a whole he advances his own best interests, as well as those of the whole engineering profession.

3. He should consider the protection of his client's or employer's interests in professional matters his essential obligation, provided these interests do not conflict with the public welfare.

4. He shall refrain from associating himself or continuing to be associated with any enterprise of questionable or illegitimate character.

5. He can honorably accept compensation, financial or otherwise, from only one interested party unless all parties have agreed to his recompense from other interested parties.

6. He must inform his clients of any business connections, interests or circumstances, such as might influence his judgmment or the quality of his services to his clients.

7. He must not receive, directly or indirectly, any royalty, gratuity or commission on any patented article or process used in the work upon which he is retained without the consent of his clients or employers.

8. He should satisfy himself before taking over the work of another consulting engineer that good and sufficient reasons exist for making the change.

9. He must base all reports and expert testimony on facts or upon theories founded only on sound engineering principles and experience.

10. He must not regard as his own any information which is not common knowledge or public property, but which he obtained confidentially from a client or while engaged as an employee. He is, however, justified in using such data or information in his own private practice as forming part of his professional experience.

11. He should do everything in his power to prevent sensational, exaggerated or unwarranted statements about engineering work being made through the public press. First descriptions of new inventions, processes, etc., for publication should be furnished only to the engineering societies or to the technical press.

12. He should not advertise in an undignified, sensational or misleading manner, or offer commissions for professional work, or otherwise improperly solicit it.

13. He should not compete knowingly with a fellow-engineer for employment on the basis of professional charges or attempt to supplant a fellow-engineer after definite steps have been taken toward the other's employment.

14. He should assist all fellow-engineers by exchange of general information and valuable experience or by instruction through the engineering societies, the schools of applied science, and the technical press.

Funds for Topographic Mapping

The $330,000 appropriation carried in the Sundry Civil Bill to care for topographic mapping work was increased to $370,000 by the Senate, but this increase was not sustained by the conferees, and an appropriation of $330,000 was all that was carried in the bill that was finally accepted.

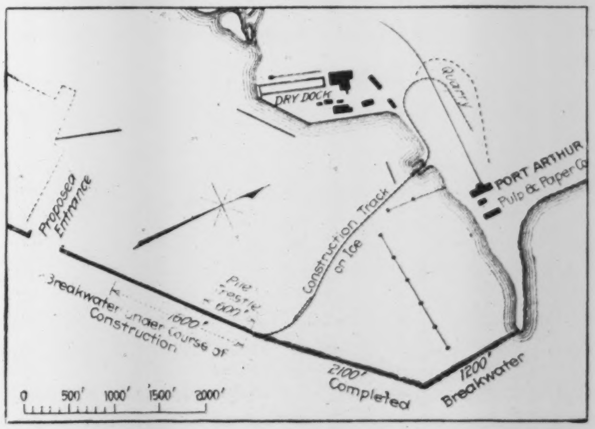
Rubble Breakwater Deposited from Railway on Ice

Work at Port Arthur on Lake Superior Carried on Throughout Winter—Terminal Dump on Trestle

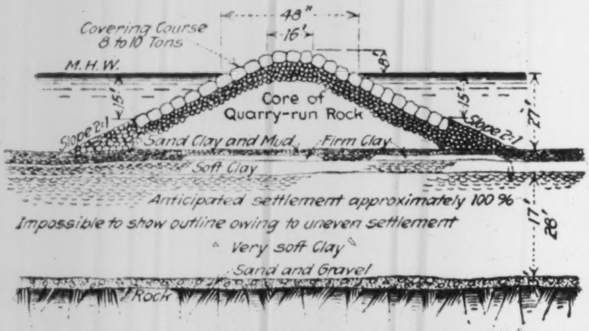
CONSTRUCTION of the new rubble-mound breakwater at Port Arthur, Ont., was carried on throughout the recent severe winter by the expedient of laying a 36-in. gage railway on the heavy ice of Lake Superior and moving the necessary rock in trains out to the work. As a rule in this northern latitude underwater work, such as breakwater, has to be shut down for the winter.

Port Arthur is the most westerly Canadian port on the Great Lakes and as such is rapidly developing as a transshipment point. Its importance is such that it has been subsidized by the Canadian Government, which is spending large sums of money there. Under the direction of F. Y. Harcourt, District Engineer for the Canadian Department of Public Works, a comprehensive plan has been prepared for the development of the harbor, consisting of dredging and the construction of a breakwater, several sections of which have already been built and which will ultimately protect the entire water front. The construction of this breakwater is now being proceeded with, and the successful tenderers on the last section let. Chambers, McQuigge & McCaffrey, Ltd., of Port Arthur, developed the ice-borne railway system here described.

The section of breakwater at present under construction is of the rubble-mound type consisting of a core of quarry run stone, with a covering course of regularly laid 8- to 10-ton stone, placed from 15 ft. below water level on both sides and extending over the top, which is 8 ft. above water level. At the water line it is 48 ft. in width, and at the top 16 ft. The estimated quantity of rock required for this contract is approximately 500,000 tons. This type of breakwater was adopted by the engineers of the Public Works Department after a large number of borings had been taken which showed that there was not sufficient holding material to support piling, thus prohibiting the adoption of the type common to this district,



LAYOUT OF BREAKWATER AT PORT ARTHUR SHOWING LOCATION OF RAILWAY ON ICE



SECTION THROUGH RUBBLE-MOUND BREAKWATER AT PORT ARTHUR, ONT.

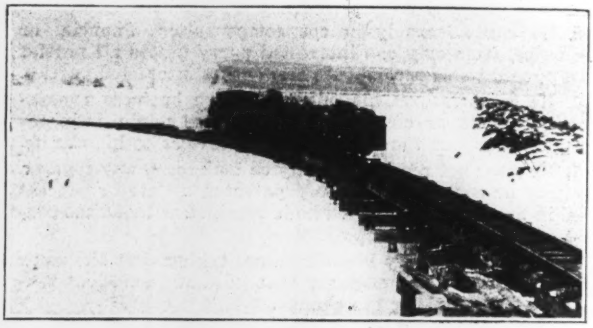
that is cribs, sunk on to a pile foundation, filled with rock and then covered with a top of mass concrete. At this point the water is from 25 to 29 ft. deep, and the bottom is very soft mud and clay to a depth of from 30 to 35 ft. before solid rock is reached.

Two sections of this type of rubble-mound breakwater have already been constructed with very satisfactory results, and two methods of placing the rock have been generally used. The bottom, up to within about 15 ft. of the surface of the water, has been placed by loading rock onto self-dumping deck-scows, which were then towed to the breakwater site, lined up between ranges, and dumped. The upper portion was then placed by loading skips, which were loaded onto scows which were towed to the site and the skips dumped by derricks on other scows. The second method was practically that usually followed in the construction of an ordinary railway embankment. The rock was loaded onto cars, which were hauled out onto a trestle built along the line of the breakwater, and there dumped. As the breakwater, as shown on the accompanying map, started out from the shore, this latter method could easily be followed. Since the completion of the last section, the construction of a large pulp mill, with several spurs and sidings to serve it, prohibited the use of this method on the present contract, for the approach to the breakwater was blocked by the pulp mill being between the quarry and the shore end of the breakwater.

It had previously been the custom to close down all work with the advent of winter, but the present contractors conceived the idea of laying a track over the ice to the breakwater and dumping the rock directly into place. After the ice had formed to a thickness of 14 in. some 3,000 ft. of track was laid from the shore to the breakwater with a passing track some 250 ft. long, and a pile trestle approach put in from the ice, up onto existing breakwater, about 100 ft. from its end. From this end, another pile trestle was constructed along the line of the new section. When the ice was 24 in. thick, the trains started hauling, and the cars were dumped from the trestle.

The tracks on the ice were laid on stringers 12 x 12 in. by 20 ft. laid end to end, carrying 2 x 6 in. by 6 ft. crossties. The object of this construction was to raise the track off the ice to avoid trouble from snow. It was found, however, that snow did not cause much interference but that a track so laid was difficult to keep in alignment, so next winter standard track ties laid directly on the ice will probably be used.

Considerable settlement took place in the pile trestle, requiring replacements of that structure from time to time. These settlements gave little warning and were likely to take place any time after the rock dump reached the water surface. The railway on the ice, however, was quite stable.

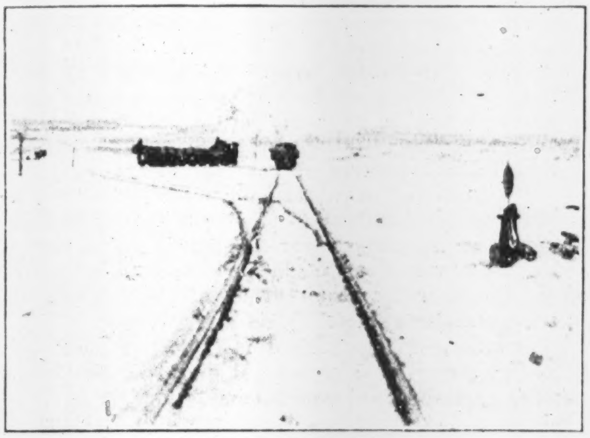


TRACK IN BACKGROUND ON ICE LEADING TO TRESTLE AT COMPLETED BREAKWATER

The rock, which is a trap formation, is obtained from a quarry located immediately opposite the breakwater. The equipment consists of four 20-ton dinkey locomotives; 36 in. gage; and some 50 dump cars of 4 cu.yd. capacity. Every car passes over a scale and is weighed, so the quantity of rock moved, which is paid for at a unit price per ton, is always exactly known. The rock is loaded by steam shovel and the

DUMP CAR TRAIN ON TRESTLE OF PORT ARTHUR BREAKWATER quarry contains the usual equipment of air compressor, air drills, plugger drills, etc.

On account of the heavy grade from the shore to the pit—6 per cent for the greater part of the distance—the engines could only haul eight of the empty cars up the hill, thus limiting the length of the train to that number of cars. Each car when loaded weighed approximately 12 tons and the engine weighed about 20 tons. To the entire weight of a train on the ice was about 116 tons, distributed over a distance of about 120 ft. The tracks at the passing siding were spaced 40 ft. c. to c. so as not to have too concentrated a load when two trains were passing each other. No difficulties whatever were experienced in running over the ice, which ultimately reached a thickness of 36 in. and an average output of something over 1,000 tons a day was maintained. Next winter the contractors expect to relay the track on the ice to complete whatever portion of their contract may not be finished by the end of the present summer.



RAILWAY LAID ON LAKE SUPERIOR ICE

Variation in the Length of Wood Fibers

THE current supposition that each species of wood has a characteristic fiber length is not born out by the many thousand measurements which have been made at the Forest Products Laboratory on wood fibers. A great difference may be found in one tree than exists between the average fiber lengths of different species. In one Douglas fir disc, for example, the fibers varied from 0.8 to 7.65 millimeters in length. On the other hand, the averages of several thousand measurements on Douglas fir and longleaf pine were less than one millimeter apart, being 4.41 and 3.67 millimeters, respectively.

During the first 20-50 years of growth, the increase in fiber length from the center of a tree outward in any plane is very striking. An approximate maximum having been attained, fiber length, though it may fluctuate somewhat, does not radically change thereafter, even in trees 400 or more years old. Some increase in fiber length occurs also for about two-thirds of the distance from the butt to the top. Within each annual ring the length of the fibers varies, particularly in the conifers, where the early springwood has the longest elements, and the last-formed cells of summerwood the shortest in the ring.

Tests Show Effect of Storage on Cement Strength

All Methods of Sack Storage Give Initial Weakness, but Strength Becomes Near Normal in Two Years

TESTS have been under way for some time in the Structural Materials Research Laboratory of Lewis Institute at Chicago looking into the effect of storage of portland cement on the strength of concrete made from it. A report on the first two years' result was made to the Portland Cement Association, under whose auspices the Laboratory is conducted jointly with the Lewis Institute, by D. A. Abrams, professor in charge, and this report has been published as Bulletin No. 6 of the Laboratory. The data given and the deductions therefrom are both novel and informing, for it is shown that for any kind of storage in sacks, varying from ideal laboratory conditions to a typical outdoor shack storehouse, there is a decided falling off in strength at the 7-day and 28-day ages of concrete, with a gradual approach of the aging concrete to the strength of specimens made from cement fresh from the warehouse. At two years, the present limit of the reported tests, the strength of concrete made from stored cement was about 85 per cent of that from fresh cement. It was also found that increased length of storage caused greater early deterioration in strength.

Extracts from Professor Abrams' report are given herewith.

Tests were made on three separate lots of portland cement, which had been in storage for periods up to two years. The cements were stored (a) in the laboratory, (b) in the basement of the building, and (c) in a shed in the yard. In general the cement was stored in lots of 800 to 1,200 lb. in standard cloth

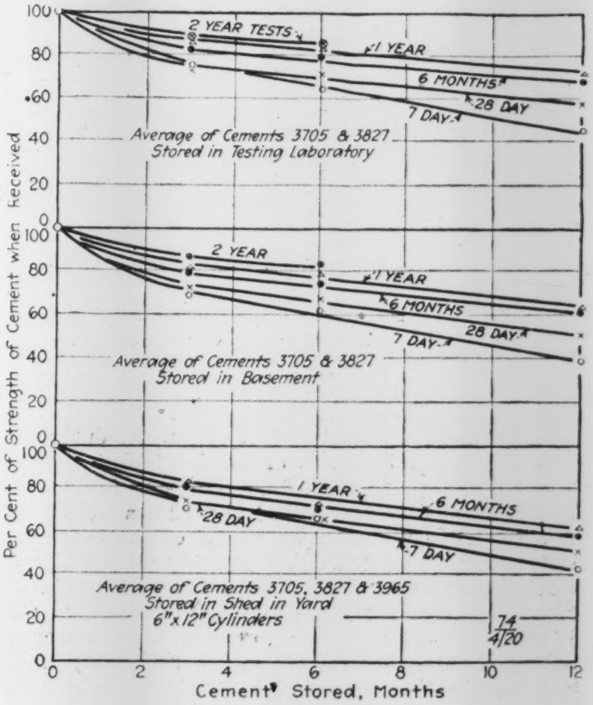


FIG. 1. RELATIVE STRENGTH OF 1:5 CONCRETE FROM STORED CEMENTS

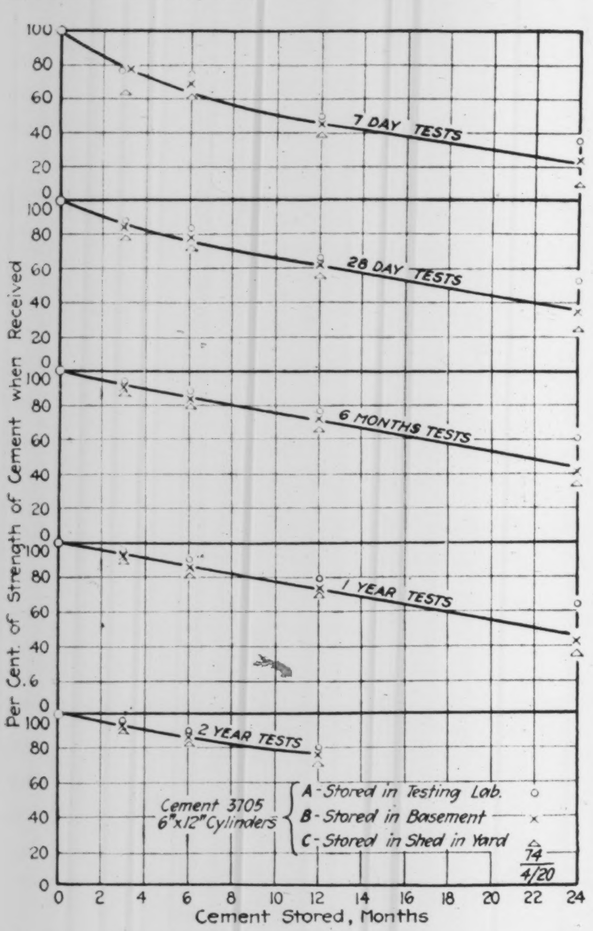


FIG. 2. AVERAGES OF TESTS OF DIFFERENT CEMENTS UNDER DIFFERENT STORAGE CONDITIONS

sacks; in one group of tests two brands of paper sacks were also used. In another group the cloth sack containers were covered with thin layers of, in one case, portland cement, and in another case hydrated lime. Tests were made at ages of seven and twenty-eight days, three months, one and two years on samples taken immediately upon receipt from the dealer's warehouses and after storage for three and six months, one and two years. The report includes compression tests of about one thousand 6 x 12-in. concrete cylinders, about one thousand 2 x 4-in. cylinders of 1:3 standard sand mortar and about 500 miscellaneous tests.

Storage conditions were as follows: (a) In testing laboratory, a large, steam heated room on the ground floor of Lewis Institute; temperature was quite uniform during the winter and humidity low during the winter. (b) In basement of Lewis Institute; temperature 5-10 deg. F. lower than (a); humidity rather high at all times. (c) In shed in yard near laboratory, no artificial heat. Sacks were piled on the floor about 1 ft. from the ground. A roof and thin board walls protected the sacks from direct contact with rain and snow, and allowed free circulation of outside air. Conditions here were similar to those in a temporary cement storage shed erected in the field. (d) Stored in laboratory two months before mixing, in a metal-lined box in basement one month after mixing. Usual conditions for cement used in the laboratory. Tests for this condition did not extend beyond the three months' storage period.

The cements used consisted of a mixture of equal parts of four brands of portland cement purchased in the Chicago market. One sack each of the four brands was thoroughly mixed dry in a concrete mixer. Before making the tests the cement samples were screened through a No. 20 sieve. In general lumps retained on the No. 20 sieve were rejected. In some of the later tests the lumps were broken and used, as noted hereinafter. Concrete consisted of one part cement and five parts by volume of mixed sand and pebbles graded up to 1½ in. Aggregates were secured from the Elgin, Ill., pit of the Chicago Gravel Co. and the artificial grading was the same for all concrete. Concrete cylinders were proportioned separately and mixed by hand. Exactly the same quantities of cement, aggregate and water were used in each cylinder, as follows: Cement, 3.8 lb.; aggregate, 27.0 lb.; water, 980 c.c. The values give a water content of 7 per cent of the weight of the dry material, or a ratio of water to cement by volume (water-ratio) of 0.86. While the normal consistency of the cement varied slightly from time to time, these variations made only insignificant differences in the water requirements of the concrete and hence were disregarded.

The accompanying Table I is typical of those published in the original report. It gives the test figures on one typical lot of cement, and Fig. 1 is a typical diagram showing the relative strength of the concrete and the different storage conditions, the different periods of storage, and age of concrete.

Discussion of Tests

Although this investigation is still incomplete, the tests have now been under way for nearly 3½ years, and it is believed that in many instances definite conclusions can be drawn.

The samples stored in the laboratory (a) were under about the most favorable conditions possible in this latitude, so long as the cement is stored in sacks. Those in the shed in yard (c) were under conditions which would be considered good for cement stored on construction work. The basement

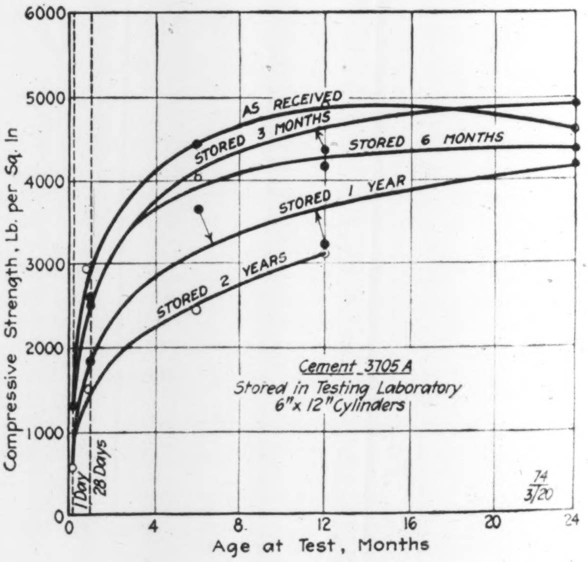


FIG. 3. EFFECT OF AGE ON THE STRENGTH OF 1:5 CONCRETE

TABLE I. COMPRESSIVE STRENGTH OF CONCRETE AND MORTAR

Cement, a mixture of four brands purchased in Chicago market.
Aggregate used in concrete, sand and pebbles from Elgin, Ill., graded 0–1¼ in.
Concrete was mixed with 7.0% and standard-sand mortar with 10.3% of water by weight of dry materials in the batch.
Concrete cylinders stored in damp sand; mortar cylinders in water.
Each value is the average of 5 tests made on diffierent days.

Group 1. Cement Lot No. 3705 Storage Began Nov., 1916

		Compressive Strength—Lb. per Sq. In.									
		1:5 Concrete (6×12-in. Cylinders)					1:3 Standard-Sand Mortar (2x4-in. Cylinders)				
		When Received	Cement Stored for				When Received	Cement Stored for			
Mark	Storage Condition of Cement		3 Mo.	6 Mo.	1 Yr.	2 Yr.		3 Mo.	6 Mo.	1 Yr.	2 Yr.
		7-Day Tests									
3705	Tested when received	1500					2,080				
3705A	Testing laboratory		1,330	1,310	900	580		1,800	1,640	1,200	920
B	Basement		1,260	1,260	810	430		1,670	1,750	960	790
C	Shed in yard		1,200	1,140	710	270		1,750	1,520	800	530
D	Laboratory 2 mo., in metal-lined box 1 mo		1,250					1,630			
		28-Day Tests									
3705	Same as above	2,940					3,800				
3705A			2,620	2,550	1,860	1,540		2,690	3,040	1,990	1,580
B			2,520	2,520	1,720	1,000		2,930	2,840	2,030	1,590
C			2,240	2,300	1,470	600		2,470	2,750	1,600	1,000
D			2,830					2,880			
		6-Months Tests									
3705	Same as above	4,450					5,130				
3705A			4,420	4,030	3,680	2,460		3,880	4,480	3,520	2,980
B			4,370	3,850	3,150	1,460		4,340	4,200	2,900	2,910
C			4,110	3,640	3,040	950		4,210	4,170	2,520	1,690
D			4,620					4,590			
		1-Year Tests									
3705	Same as above	4,930					5,060				
3705A			4,370	4,190	3,250	3,150		4,220	4,540	3,830	3,370
B			4,510	3,820	3,190	2,280		4,540	4,290	3,400	3,040
C			4,290	3,720	3,120	2,160		4,420	4,500	2,430	1,900
D			4,940					4,280			
		2-Year Tests									
3705	Same as above	4,610					4,600				
3705A			4,900	4,340	4,190	*		4,300	4,210	3,550	*
B			4,580	4,250	4,270	*		3,650	4,100	3,820	*
C			4,410	3,760	3,990	*		3,970	4,490	2,800	*
D			4,820					4,070			

* Tests not due.

storage (b) was intermediate between (a) and (c) so far as humidity conditions were concerned. The use of paper sacks and the covering of cloth sacks with portland cement or hydrated lime were variations of the shed storage.

In the following discussion the strength of concrete and mortar will be compared to the strength of similar specimens tested at the same age using the cements as received from the dealers' warehouses. In other words, the strength of the cement in the condition received, tested at a given age is taken as 100 per cent, the strength at the same age after storage will be some smaller percentage. Care must be taken to distinguish between the *storage period* of the cement and the *age at test* of the concrete and mortar.

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1. There was no essential discrepancy between the indications of the compression tests of 1:5 concrete in the form of 6 x 12 in. cylinders and the tests on 1:3 standard Ottawa sand mortar in 2 x 4 in. cylinders.

2. Compression tests of concrete and mortar showed a deterioration in strength with storage for all samples of cement, for all conditions and periods of storage and at all test ages. The deterioration was greatest for the samples stored in the shed in yard, and least for the samples stored in the laboratory. The basement storage was nearly as severe as outdoors. The deterioration was greater during the first three months than for later three-month periods. A greater deterioration was found in the tests made at the age of seven days than at twenty-eight days and later test ages.

3. The effect of storing cements under different conditions for periods up to two years is given in Table II. The value for samples (a) and (b) are from two lots of cement; samples (c) are from three lots of cement, including different types of sacks and different covering materials. After three-months storage in shed in yard (c) the cement had 80 per cent of its original strength; after six-months, 71 per cent; after one-year, 61 per cent; after two-years, 40 per cent. Laboratory storage was less severe, especially after the one-and two-year storage. Deterioration was probably greater in these tests than would be found in a large lot of cement stored under similar conditions.

4. The effect of the age at which concrete and mortar tests are made is shown in Table II. For this comparison we have chosen the "shed-in-yard" storage for three reasons:

a. This storage condition is the most severe of those used.

b. We have tests for this storage for three different lots of cement.

c. The effect of age at test is approximately the same for all storage conditions.

Table III brings out a remarkable feature of this investigation in showing that the *effect of storage of cement is largely a question of the age at which the concrete or mortar is tested.* The average concrete strength (for all the periods of storage shown at seven days is 64 per cent of

TABLE II. EFFECT OF STORAGE CONDITION OF CEMENT

		Relative Strength of Cement After Storage Periods of								
		1:5 Concrete (6x12-In. Cylinders)				1:3 Standard Sand Mortar (2x4-In. Cylinders)				
Storage Condition of Cement	When Received	3 Mo.	6 Mo.	1 Yr.	2 Yr.	3 Mo.	6 Mo.	1 Yr.	2 Yr.	Average
— When received	100									100
(A) Testing laboratory	...	82	78	69	53	78	80	64	51	69
(B) Basement	...	77	74	66	36	75	76	61	49	64
(C) Shed in yard	...	80	71	61	40	75	73	58	36	62
Average		80	74	65	42	76	76	61	45	

TABLE III. EFFECT OF AGE OF TEST SPECIMEN

Cement Lot No.	Placed in Storage in Shed in Yard	Average of Tests After Storage Periods	When Received	Relative Strength of Cement When Tested at Ages of — 1:5 Concrete (6x12-In. Cylinders) 7 d.	28 d.	6 Mo.	1 Yr.	2 Yr.	1:3 Standard Sand Mortar (2x4-In. Cylinders) 7 d.	28 d.	6 Mo.	1 Yr.
3705	Nov., 1916	3 and 6 mo., 1 yr.	100	54	69	78	80	81	62	62	70	76
3827	May, 1917	3 and 6 mo.	100	63	57	65	72	79	68	69	73	76
3965	Nov., 1917	3 mo.	100	74	87	92	93	94	80	70	72	75
Grand average			100	64	71	78	82	85	70	67	72	76

the strength when received; at twenty-eight days, 71 per cent; at six months, 78 per cent; at one year, 82 per cent, and at two years, 85 per cent.

This most significant relation is shown in both concrete and mortar tests of all samples of cement for all conditions of storage. Cements stored in laboratory show a smiliar variation with the age at which the *concrete is tested.*

It is a matter of utmost importance to know that the strength of concrete is not permanently reduced to the low values found in the early tests, but that at the later test periods the strength again approaches that before storage began. It should be borne in mind that the concrete and mortar specimens were stored in a damp place. The grand averages in Table III will probably be reduced when complete data of all tests up to two-year storage are available.

5. For periods up to one and one-half years there is no marked difference in the quality of the samples of cement stored in cloth or in paper sacks. The two brands of paper sacks gave almost identical results. The comparison between cloth and paper sacks is given in Table IV. If the strength of the cement when received is considered as 100, the average of cloth-sack storage for all test ages is 62, for "Jaite" paper sacks 65, and for "Bemis" paper sacks 63.

TABLE IV. EFFECT OF TYPE OF CEMENT SACK

Storage Condition of Cement	When Received	Relative Strength of Cement After Storage Periods of — 1:5 Concrete (6x12-In. Cylinders) 3 Mo.	6 Mo.	1½ Yr.	1:3 Standard Sand Mortar (2x4-In. Cylinders) 3 Mo.	6 Mo.	1½ Yr.	Average
When received	100							100
(C) In shed in yard—Cloth sacks		67	64	46	74	71	52	62
(D) In shed in "Jaite" paper sacks		73	66	50	76	72	54	65
(E) In shed in "Bemis" paper sacks		72	62	48	71	74	53	63
Average		71	64	48	74	72	53	–

6. The experiments in Group 3 on the use of portland cement and hydrated lime as a covering for cloth sacks showed only a slight advantage from the protection furnished in this way. There seems to be little room for choice between the two materials. The average of all concrete and mortar tests up to one year of age are given in Table V.

If the strength of the cement when received is considered as 100, the average of cloth sacks uncovered (for storage periods of three months to two years) is 62; for sacks covered with hydrated lime, 67; and for sacks covered with portland cement, 66. The beneficial results do not justify the cost of these methods of protecting cement stored in sacks.

7. The most favorable storage condition (in laboratory) and the least favorable conditions (in basement and in shed in yard) gave strengths of the same order of magnitude, indicating that the possibilities of improving the storage condition of cement *in sacks* in this climate is rather limited. The *storage period* and the *age of the concrete or mortar at test* appear to be of greater importance than the exact *condition of storage,* so long as the cement is protected from direct contact with moisture.

8. Storage of cement had the effect of prolonging the time of both initial and final setting as determined by the Vicat and Gillmore needles. Setting time was increased 25 to 50 per cent for samples stored one year and to a greater extent for samples stored two years.

9. All samples of cement were sound in the standard test over boiling water, hence no information was secured on this property.

10. The normal consistency of the cement as determined by the Vicat needle was only slightly affected by storage. For cements stored one and two years the normal consistency was in some instances increased from about 23 to 24 or 25 per cent.

11. A steady increase in CO_2, moisture, and loss on ignition, shows the result of absorbed moisture and carbon dioxide during the storage of cement in a humid climate.

12. Deterioration of cement in storage appears to be due to absorption of atmospheric moisture, causing partial hydration which exhibits itself principally in reducing the early strength of concrete and prolonging time of setting.

The exact method of dealing with lumps in stored cement is a complicating feature of such tests as those covered by this report. In the earlier samples all lumps coarser than No. 20 sieve were screened out and rejected before the cements were subjected to test. No lumps or only soft and readily broken lumps were found in the cements which had been stored less than one year. One cement placed in storage in the fall of the year in shed in yard for one year showed about 8 per cent of lumps coarser than the No. 20 sieve. These lumps were soft and easily crushed in the fingers. After two-year storage the condition was about the same.

Another cement stored in the spring of the year in shed in yard gave about 12 per cent of lumps at the end of one year. After two years' storage this sample showed 30 to 75 per cent lumps. These lumps were broken on the concrete floor with a metal tamper and used in the concrete. Even in this condition the cement had considerable strength.

Another series of concrete tests (not reported in detail) in which broken lumps only after two years' storage in shed in yard were used, showed a strength at ages of seven days to two months of 40 to 50 per cent of the strength of the other cement from the same sacks. The lumps in this case were quite hard, requiring a sharp blow from a hammer to break them.

Lumps due to absorption of moisture should not be confused with lumps due merely to pressure of the superimposed pile of cement sacks.

TABLE V. EFFECT OF HYDRATED LIME AND PORTLAND CEMENT AS COVERING OF CEMENT SACKS IN STORAGE

Storage Condition of Cement	When Received	Relative Strength of Cement After Storage Periods of — 1:5 Concrete (6x12-In. Cylinders) 3 Mo.	6 Mo.	1 Yr.	2 Yr.	1:3 Standard Sand Mortar (2x4-In. Cylinders) 3 Mo.	6 Mo.	1 Yr.	2 Yr.	Average
When received	100									100
Sacks uncovered	...	85	71	54	45	72	70	67	35	62
Sacks surrounded by hydrated lime	...	92	80	69	48	81	65	60	43	67
Sacks surrounded by Portland cement	...	87	82	61	52	75	76	59	43	66
Average	...	88	78	61	48	76	69	62	40	

Notes from Foreign Fields

RANDOM HIGHWAY OBSERVATIONS IN ENGLAND

BY

E. J. Mehren

EDITOR ENGINEERING NEWS-RECORD

SUNDAY is surely holiday time in England. Agreeable to that spirit I had the opportunity last Sunday of motoring through parts of the counties of Essex and Suffolk, lying to the northeast of London. It was a trip without technical guidance and my observations, therefore, are unchecked or enlarged by the information obtainable from a roads authority.

The trip lay through the beautiful English countryside, put under cultivation almost to the last square foot. Fields, gardens, hedges, road-sides—all were beautifully cared for. The road surfaces were mostly water-bound macadam with a gravel sprinkling, or wearing coat, though here and there were stretches that had tar surface treatment.

Taking them all in all their condition was very good. Occasionally a stretch would be found in which there were pot-holes, but these were seldom closer than 10 ft. and rarely were there two side by side. Seldom, too, were they greater than 15 or 18 in. in diameter. Our host regarded these roads as wretched and apologized profusely for their condition. In America we expect to find macadam and surface-treated roads so much worse every spring that my American companion and I saw no reason for the profuse apologies. We would not have said that these sections were in first-class condition, but, on the other hand, we would not have called them bad.

It being Sunday, we were not able to form any impression of the traffic normally carried by the roads. We saw only horse-drawn carts, passenger automobiles, and a few double-decked motor buses. We were assured, however, that all of these roads and we went as far north as Bury St. Edmunds—carry a heavy motor-truck traffic on week days. During the war, particularly, they are said to have had a very severe pounding. They were then, it was said, in bad condition, but all vestiges of the destruction by the war traffic have now been obliterated.

Road widths were from 18 to about 22 ft., and, much to our surprise, the sides of the paved width were bordered immediately by the grass plots. These plots are raised so as to form a curb 6 to 8 in. high. There are no shoulders, as we know them—and that is, unmetaled or unpaved strips on either side. The effect is, of course, to make a narrower road than is customary with us, but a road the full width of which is metalled. I commented upon this to Sir Henry Maybury, director of the Roads Department of the Ministry of Transport, a position corresponding to that of Mr. McDonald in our Bureau of Public Roads. He told me that their experience with natural earth shoulders in England had been a very unsatisfactory one. Invariably a bad rut developed at either edge of the paved way, this being so serious a feature that it has been dubbed in England the "pig trough." This would tend to indicate very heavy traffic, so heavy as to force the drivers on to the shoulders if used. Sir Henry assured me that the practice universally is not to use unpaved shoulders.

We saw only one piece of work under way, a resurfacing job on top of a tar-bound or tar-treated macadam. A single course of stone graded in size up to about 2 in. maximum was put down and given a tar coat, this was rolled and covered with chips.

In many cases, the usual water-bound macadam was given a light dressing of gravel, of a maximum size of ½ in., carrying a very heavy proportion of coarse sand.

Another feature unusual to the American eye was the well-maintained gravel footways along, as a rule, one side of the highway.

These remarks, it should be pointed out again, are merely random observations. I hope later, after conference with some of the highway officials, to be able to give technical details.

In closing I want to note that an American is astonished at the very great amount of waterbound macadam carrying heavy traffic. In railroad trips through the country I have seen heavy lorries running at high speed over these waterbound macadam roads. How does waterbound macadam stand up under such traffic? Or does it actually stand up? On these points I am seeking enlightenment.—London, May 13, 1920.

Wet Aggregates Make Concrete Too Strong

TESTS recently announced by the U. S. Bureau of Standards show the importance of noting the moisture of sand in concrete work. When aggregates were proportioned by volume measure, as is customary on most construction work, it was found that the use of wet aggregates requires ½ to 1 bag more cement per cubic yard of concrete than do dry aggregates. Sand is generally wet or at least moist when used, so that the full difference may never be apparent in field practice, yet the use of sand from a pile which has just been exposed to rain will result in the employment of more cement for a given volume of concrete than would have been the case had the work been done on a dry day. The excess strength resulting from the increase in cement is unnecessary providing that designed strengths were obtained with the drier materials. This increased quantity of cement may be as high as one bag per cubic yard of concrete, and the increase in strength, due to the added cement in a cubic yard of concrete made with wet aggregates, is roughly proportional to the increase in cement. Therefore, if there is a marked increase at any time in the moisture carried by the sand, the tendency on the job should be to use larger volumes of sand in the batch. According to the announcement of the Bureau, marked improvement in the working qualities of the concrete will be noted under usual conditions when the relative volume of sand is increased and the gravel proportionally reduced. With well graded river sand and gravel, such as is available in the District of Columbia, the "oversanding" may be beneficlai up to the point where the volume of sand in the batch is equal to the volume of the gravel. Such concrete will not segregate for maximum flowability commonly used in construction work; it will be easier working, the quantity of cement required per cu. yd. will be slightly less and there will be no reduction in compressive strength.

LETTERS TO THE EDITOR

Prohibition and the Foreign Born

Sir—My interest has been aroused by the letters published in *Engineering News-Record*, June 3, p. 1122, concerning "Prohibition and the Foreign Born." Why is it that so many people fail to see a moderate course, but always look at one extreme or the other? This, I think, is especially true of the average prohibitionist. To such a person, "drink" is synonymous with "whiskey." But why? It shouldn't be. Mr. Satterthwait says in his published letter, "Whiskey is the monkey-wrench in the machinery of industry." Granting it, is that any reason for absolute prohibition? Cannot the rabid prohibitionists conceive of a moderate course, doing away with whiskey and gin but leaving the harmless or at most very slightly harmful ales, beer, and wines? I believe that the average Italian laborer cares far more for his wine than for whiskey and gin, and if these latter drinks were dispensed with, immigration would not be materially affected. But unfortunately there are still some extremists who cannot conceive of prohibiting anything without prohibiting everything, and these very people are often the ones who criticise the extremity and radicalism of the "reds" and I. W. W.'s. A good policy for everyone to pursue would be that of the old motto, "Moderation in all things." There is at present all too much proneness to extract a mote from some one else's eye, while having a beam in one's own. I do not mean by this that the reds are any less bad than they are pictured, but, rather, that many others are much worse than they believe themselves to be. Perhaps a common-sense liquor policy in this country would induce the return of the normal immigration tide from Europe. If so, that would be far, far preferable to the importation of Chinese labor, against which I always have been, and always will be, prejudiced, a feeling due perhaps to the fact I was born and brought up on the Pacific Coast.

Troy, N. Y. CHARLES SHEPARD.

Shall Chinese Labor Be Imported?

Sir—Referring to a letter of H. S. Crocker, acting secretary of the American Society of Civil Engineers, appearing in your issue of June 17, p. 1219, wherein he calls attention to a letter of mine in your issue of June 3, p. 1121, stating the number of members and associate members of the society to which letters relative to importation of Chinese labor were sent, as about 2,000 in all, I beg to call your attention to my original letter, of which said letter is supposed to be a reprint and wherein the number is given as about 7,000 instead of 2,000.

The number of letters actually sent was 7,975, of which 101 were returned undelivered. The number 2,000 in the letter as published is therefore, a misprint.

JOHN ERICSON,
Chicago. Consulting Engineer.

[The facts are correctly stated by Mr. Ericson. This journal is responsible for the typographical error referred to.—EDITOR.]

Sir—Enclosed you will find a copy of a letter written to John Ericson, consulting engineer of Chicago, in reply to his circular letter concerning the modification of the Chinese exclusion act. I read with considerable interest some of the comments in the recent issues of *Engineering News-Record* relative to the letter of Mr. Ericson's, and if you should wish to make use of any portion of the enclosed you are at liberty to do so. WILLIAM R. CONARD.

Burlington, N. J.

[A copy of Mr. Conard's letter to Mr. Ericson follows.—EDITOR.]

June 14, 1920.

As to the desirability and feasibility of so modifying the exclusion act as to allow the importation under certain restriction of Chinese laborers, I cannot feel that this is going to help solve the matter in really a proper manner. I will say, however, that I have never been able to reconcile in my own mind why America should exclude the Chinese and Japanese and allow entrance to other foreigners, among whom are found those who stir up trouble—as they have done—among both the Americans and those foreigners who come here with the intention of making this country their home, and who appreciate some of the blessings they are allowed to possess in this country. If there is to be a modification of the immigration restrictions it must, in my judgment, be along such lines that that undesirable class, no matter what color or nationality, shall be excluded.

In considering this question, we must not lose sight of the fact that not only is there some shortage of unskilled labor, but that unskilled labor is not producing either the quantity or quality of work of some years ago. The further fact is apparent that those who may have graduated from the unskilled to the semi-skilled and skilled classes seem to have been spreading the propaganda that "work" or "labor" or "production" or whatever term may be applied, is degrading, until this belief is impressed on the minds of the unskilled, all of which serves to lower efficiency.

The Good Book, which should be the rule and guide for our conduct, tells us that we shall gain our bread by the sweat of our brow. If labor of every class would bear this in mind, in this the best country on the face of the globe, and adopt as its watchword that greatest of all rules of living: The one given us by the Master—"That which ye would have others do unto you do ye also unto them," it is my belief we would find that, by everyone putting his shoulder to the wheel, there would not be such a labor shortage as some of us imagine.

Another fact is that within a comparatively short time the tide has begun to turn and there are more immigrants coming into this country now than we are losing, a condition which encourages me to believe that in the not too distant future, matters will naturally return to a normal basis.

Practical Designer vs. Theorist Again

Sir—I note Prof. Clyde T. Morris' criticism in your issue of June 10, p. 1172, of my article of May 13, p. 948. In this correction please note that two typograhical errors exist in the article. On page 948, near Fig. 1 the word "no" should be omitted, making it read "Engineers wisely allowed unit stresses higher." On page 949, about the middle of the first column, the word "connecting" should be "connoting."

Prof. Morris says of my Fig. 2, "The 'theorist' will immediately tell you that the bending moments in the two cases A and B are not equal. The bending caused by the 100,000-lb. load on top of column A will relieve some of the pressure on the ball and reduce the bending moment on the column." This is error No. 1. The pressure on the ball would be reduced about 400 lb., a trifle, and the eccentricity of the 100,000-lb. load will supply the bending moment, leaving it exactly the same as it was. The bending is due to the constrained shape of the column.

He further says, "On the other hand the bending moment in the column B will be increased by the deflection of the column under the 100,000-lb. load." This is error No. 2. The end load would in fact add something like $\frac{1}{8}$ in. to the deflection of a column bowed 3 in., but the figure shows 3 in. as the deflection under load, which includes the original bow of the columns, if Prof. Morris wants to go into such fine points.

Prof. Morris goes on to figure out what ultimate load these columns would sustain, using 32,000 lb. as the unit stress at the limit of usefulness. Columns A are already strained to 22,000 lb. per sq.in., 10,000 lb. from the direct direct load and 12,000 lb. from the constrained shape (due to the pressure on the ball). An added load of 100,000 lb. will add the 10,000 lb. of unit stress, making the total 200,000 lb. and not 240,000 lb. as Prof. Morris states. Error No. 3. On the bowed column each 10,000 lb. of added load increases the direct-load unit by about 1,000 lb. and the bending unit by about 1,200 lb. Hence the bowed column could take roughly 145,000 lb. instead of 130,000 lb. Error No. 4.

In any event it is a matter of little consequence whether Prof. Morris' figures for the ultimate load or mine are correct: it does not affect my proposition in the least. A little change in the loads, etc., could be made that would give identical unit stresses at 32,000 lb. as easily as 22,000 lb. The question regarding the twin columns is not what would be the relative values of these columns if they had much heavier loads on them, or even were tested to destruction; but with unsafe loads on them, as they now have, judging by unit stresses, and the unit stresses identical, why are they not both equally unsafe? I, for one, in spite of the calculated unsafe unit stress of columns A would not hesitate to say they are safe. I would just as promptly pronounce columns B unsafe.

The thing is put in this shape, not to create an impossible condition, but to show an analogy where the actual disparity in safety between two columns identically stressed is so patent that no engineer can dispute it. The analogous case I gave in an article in your issue of Oct. 16, 1919, p. 730. In that article I criticised a detail of a girder resting on a bracket on one side of a column and failure to consider the bending moment. It was recommended that the girder be rigidly riveted to the side of the column and the bending moment thus thrown into the girder and ignored in the column. Theorists objected to this and pointed out the bending moment due to deflection, which, theoretically, might be more than in the bracket detail.

The case of the twin columns is completely analogous with that of my Fig. 1 in the Oct. 16 issue. It ought to be enough to convince anyone of the correctness of my position that such secondary stresses may be ignored and that rigid connections are immensely better than articulated ones in spite of those ignored secondary stresses.

Pittsburgh. **Edward Godfrey.**

To Strengthen the Winnipeg Aqueduct Drainage System

Sir—I have read with great interest the article on alkali damages to the Winnipeg concrete aqueduct and the means of preventing their further progress, which appears on p. 1097 of your June 3 issue. The remedies proposed and shown in detail in the article are, of course, standard ways and certain of success. The idea of protecting concrete conduits from alkali action by drainage through vitrified clay pipes goes back to the first observations by engineers of a series of difficulties along this line which occurred at Great Falls, Montana, and which were studied in detail by the Montana Agricultural College Experiment Station. Among the recommended remedies for these disintegrations was a system of under drains similar to the one you describe, and the protection of the surfaces of the structure by a vitrified clay tile lining.

Since that time the excellent work of the American Society for Testing Materials, of the Bureau of Standards and of the Iowa State College of Agriculture and Engineering—not to mention others—all co-ordinated, has resulted in specifications for vitrified clay drain tile which make it, more than ever, proof against failure from chemical causes. There is, however, one weak point which I see in the details of the proposed Winnipeg system which may cause failure from breakage. The design calls for a standpipe every thousand feet, rising from the longitudinal vitrified clay drains. The connection between the drain and the standpipe is made by a standard 8 x 8 x 6 vitrified clay T. The weight of the standpipe is, of course, not sufficient to crush the T, but the weight of the earth which clings to it and hangs upon its sockets during settlement is very considerable, and it will have a great tendency to push the standpipe down through the drain line and crush the T. This 8 x 8 x 6 T should, therefore, be securely foundationed on a small concrete block, and the concrete should surround it entirely and come well up upon the first length of pipe which enters it so that the weight of the settled earth will be taken directly in compression in the standpipe, instead of Transversely in the T. It is quite conceivable that the engineers have already taken this into account, although their general plans do not show this small detail. But since this is one of the little details the failure to observe which will completely block the drainage, I have ventured to call attention to it.

Benjamin Brooks,

Chicago. Engineer, Clay Products Association.

Effect of Flange Holes in Beams

Sir—In connection with Mr. Fleming's discussion of the weakening effect of flange holes in beams, in his article "Stray Points in Structural Steel Design" in *Engineering News-Record* of May 27, 1920, I note the American Bridge Co.'s specifications for steel structures, as we have them in the Carnegie Steel Co. handbook, call for rolled beams and built-up members used as beams and girders to be proportioned by the moment of inertia of their gross sections. Most text books on the subject, I believe, use the net flange area in figuring the strength of such beams. I should like to know if any tests have been made to show whether the weakening effect of holes in girder and beam flanges is as great as the theory would indicate. It seems to me the differences in practice noted above in this respect would justify such tests if they have not already been made.

D. M. Dodds,

Kansas City, Mo. Structural Engineer.

Rectangular Co-ordinates for Maps

Sir—In an article of mine entitled "Rectangular Co-ordinates Used in Surveys and Maps," published in *Engineering News-Record*, May 13, p. 962, it is stated that some work has been done toward applying a grid system to the polyconic projection of maps as used in the United States. Since that article was published I have received from William Bowie of the U. S. Coast and Geodetic Survey its special publication No. 59, "Grid System for Progressive Maps in the United States," a publication containing complete tables and instructions for applying a grid system to a map of any part of the United States, based on the polyconic projection. It would be of great value to anyone interested in this general subject. **H. A. Foster.**

South Orange, N. J.

Should the Snow Loading Allowance on Roofs Be Increased?

Sir—As an aftermath of the past winter and the severities of weather incident to it, it is of interest to note the snow fall which occurred during that period.

It is commonly supposed and indeed stated by the "oldest inhabitants" that the snow conditions were more severe than ever before remembered or experienced. To verify the above general opinion and to determine the loading and effect at the time when snow conditions seemed to be at their maximum, some of our senior engineering students were directed to find out what the actual weight was. For this purpose they marked out an area of known size and proceeded to weigh all the accumulated snow within this limit, taking into account the ice which underlay the snow. It was found that the loading reached the amount of 35 lb. per square foot of area.

The location chosen was on a level part of the campus, the nearest building being about 40 ft. to the south. It was, therefore, felt that the conditions as tested might serve as a suitable gage for the loadings for roofs which had not been subject to the heat of buildings and consequent thawing.

Since the figure commonly employed in this latitude for maximum snow loadings on level roofs is about 30 lb. per square foot, it seems to be a pertinent question as to whether this limit should not properly be increased in view of the experiences of the past few months.

Sydney Wilmot,

Assistant Professor of Civil Engineering.

Brown University, Providence, R. I.

HINTS FOR THE CONTRACTOR

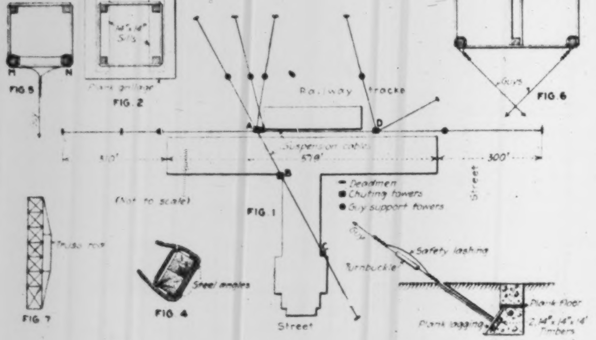
Details of Tower Guying Methods for Concrete Chuting Plant

WITH railway tracks and two streets to be spanned by guys from the four chuting towers, especial means for supporting and fastening the steel cables were employed on the Bunte factory building in Chicago. The locations of the various towers are indicated on the diagram plan, Fig. 1. Only those guys which involved some special problem are indicated. Incidentally it will be observed that the chute suspension cables have exceptional lengths of span.

There are four chuting towers. One at *A* is a double-hoist tower 230 ft. high. Towers *B* and *D* are auxiliary towers 180 ft. and 150 ft. high, respectively, and tower *C* is a rehoist tower 180 ft. high. All four towers are carried on plank grillages as indicated by Fig. 2, it being the experience of the contractors that this construction is a wise precaution against settlement. The towers are guyed with ⅝-in. wire rope at approximately 50 ft. vertical intervals. All cables are anchored to deadmen constructed as indicated by Fig. 3. The construction of the deadmen is noteworthy in the respects, (1) that the anchor timbers bear full length against a plank lagging, (2) that the anchor pit has a plank flood or bulkhead so that the backfill on top acts as a unit, and (3) that where the anchor cable is lashed around them, the timbers are armored as indicated by Fig. 4.

The guys are attached to the anchorage by turnbuckles as indicated by Fig. 3, and to prevent accident, should a turnbuckle connection fail a safety lashing of cable is provided as indicated. These lashings are quickly installed by means of cable clamps. At the tower ends the guys are fastened as indicated by Fig. 5. Coming from the ground the free end of the cable is given two turns around post *M*, then two turns around post *N* and then is carried back and clamped to the guy line. With this fastening a double connection is secured and the pull on the tower posts is symmetrical. At the double tower, Fig. 5, the guys are led away from the tower on intersecting lines. By this arrangement, it is practicable by means of the guys to rectify the lateral twists to which double towers are liable. In constructing the guy support towers, Fig. 7, which hold the lower guys clear of the streets and the railway tracks, a truss rod is used to give stiffness without heavy framing.

The construction to which the described practices relate is being carried out by R. C. Wieboldt, general contractor, Chicago.



GUY CABLE FASTENINGS, ANCHORAGES AND SUPPORTS

Temporary Trusses Support Roof Forms

By P. S. Toney

Engineer, Sinclair Refining Co., East Chicago, Ind.

BY erecting temporary trusses, no scaffolding was required for erecting or dismantling the forms for a wide-slab, concrete-tile roof for a new boiler house for the Sinclair Refining Co. at East Chicago, Ind. The roof, 50 x 90 ft., is divided into three sections: A monitor 12 ft. wide, and two sections approximately 18 ft. wide, one on either side of the monitor. The roof is supported by a wall at one end and by four trusses spaced 22 ft., c to c. The monitor, as will be seen from the illustration, is supported between trusses by lattice girders. The bottoms of the trusses are 35 ft. above the boiler room floor. The problem was to support the roof form between trusses—22 ft.—and between the girder beneath the monitor and the outside brick wall—18 ft.

TIMBER TRUSSES CARRY ROOF FORMS

A temporary truss was designed to carry a total load of 26,400 lb. using a factor of safety of 2½, having a span of 22 ft. and a depth of 3 ft. 6 in. Eight trusses were constructed of 2 x 8-in. plank, six being 22 ft. in length and two, 22½ ft. long. The longer ones were used in the end bay, with one end let into a slot left in the brickwork. To allow for ease in wrecking, these trusses were made 2 in. shallower than required and to bring them to the desired height wedges were driven under them at either end. Three courses, one brick wide, were left out on the inside of the 12-in. wall to receive the ends of the roof joists, while the remaining portion of the wall supported the concrete slab.

The trusses were hoisted to place and firmly secured by wedges. A 4 x 4-in. stringer was shored up from the lattice girder to the proper height and wired in place. The roof joists were then laid on 24-in. centers between the 4 x 4 and the truss and between the truss and the recess previously mentioned in the brick wall. Upon this ⅞-sheeting was laid. The contractor was the Leonard Construction Co., Chicago.

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

NEWS OF THE WEEK

New York, June 24, 1920

County in Arizona Lets $4,000,000 Concrete Highway Contract

Maricopa County, Ariz., has recently entered into a contract with Twohy Bros., of Seattle, Wash., for the construction of a comprehensive system of concrete highways which, it is estimated, will take more than $8,000,000 to complete. The contract so far executed by the county calls for the construction of 9-, 16-, and 18-ft., one-course concrete pavements, 6 in. thick, to cost approximately $4,000,000.

When the county made the $4,000,000 available through bond issues, it was thought that a 4-in. pavement would be of sufficient thickness to carry even the traffic of the future. However, since that time it has been demonstrated that 4 in. is not of sufficient thickness, and additional money will therefore be required to complete the concrete road system so that it will sustain any traffic which it is called upon to bear. In order to provide additional funds a plan is now on foot in Maricopa County to float another bond issue of approximately $4,000,000.

Forty-Six Projects

There are forty-six projects in the program as outlined, comprising a total mileage of 282.2 mi. The contractor bid upon a mileage basis for the 9-ft., 16-ft., and 18-ft. pavements in thicknesses of 4, 5 and 6 in. The bid upon which his contract is based calls for the construction of 9-ft. pavement, 6 in. thick for $18,358.34 per mile; 16-ft. pavement, 6 in. thick, $28,290.86 per mile; and 18-ft. pavement, 6 in. thick, $31,404.16 per mile. These prices include the cost of pavement complete, including excavation, concrete headwalls, reinforcing steel, pipe hand-rails, and miscellaneous concrete structures, and all labor, equipment and materials.

Construction is expected to start some time around Aug. 1. Approximately 300,000 cu.yd. of excavation are included in the contract, and though a great amount of 9-ft. pavement no doubt will be laid, the grading is to be done for the full width of the road. The Maricopa County Highway Commission has not definitely decided as to how much of each of the three widths of pavement will be used, so no exact contract price is available. There is, however, a tabulation in the contract of the following known quantities: Concrete structures, 3,341 cu.yd.; reinforcing steel, 210,823 lb.; concrete headwalls, 1,093 cu.yd.; pipe hand rail, 1,021 lin.ft.; and pipe culverts, 24-in., 5,479 lin.ft.; 30-in., 1,153 lin.ft.; 36-in., 1,382 lin.ft.; 42-in., 615 lin.ft.; and 48-in., 603 lin.ft.

Construction Division Becomes Part of Quartermaster Corps

By provisions of the recently enacted army reorganization bill the construction division of the army becomes a part of the Quartermaster Corps. Before the war the construction activities of the army in this country were in the hands of the Quartermaster Corps, but as soon as camps for the draft army were required a cantonment division, under the Quartermaster Corps, was organized. This was later changed to the construction division, reporting directly to the general staff and the Secretary of War. The formal order providing for the transfer has not been issued. It is expected, however, that the Secretary of War would issue the order within a few days. Maj. Gen. Harry L. Rogers, the Quartermaster General, states that there will be no change in the operation of the Construction Division. It will continue its work, he said, in the same way that it has been conducted, the only difference being that it will be under the immediate direction of the Quartermaster General rather than the General Staff.

Bridge Washout Breaks High Pressure Gas Mains

On June 17, 1920, a highway bridge spanning Chartiers Creek near its mouth and connecting Pittsburgh with McKees Rocks, Pa., was wrecked due to the washing out of the west abutment. A heavy storm of the previous day and night caused a sudden rise in Chartiers Creek and the swift current undermined the upstream end of the west abutment, causing it to fail. The bridge dropped into the stream and was carried down stream about one hundred feet, passing entirely beneath the adjacent four-track bridge of the Pittsburgh & Lake Erie R.R.

The bridge, which was an old one, consisted of two through steel trusses of about 140 ft. span. Sidewalks had been provided outside the trusses but the downstream sidewalk had been removed and the brackets used as a support for two 8-in. high-pressure gas lines and a ten-inch water line. The bridge carried two street-car tracks as well as providing for ordinary traffic. The wrecking of the bridge broke the gas lines and the gas was ignited and for a short time the flames threatened the adjacent railroad bridge.

As this was the only highway bridge spanning the stream in this vicinity, it will be necessary to provide a temporary bridge immediately to accommodate the heavy traffic at this point, pending the construction of a permanent bridge.

President Signs Water-Power Bill

Attorney General Rules that Adjournment of Congress Does Not Invalidate 10-Day Time Limit

On June 18 announcement was made from the White House that the President had signed the Water-Power Bill within ten days after it had been submitted to him. The statement follows:

> "The President having been advised by the Attorney General in a formal opinion that the adjournment of Congress does not deprive him of the ten days allowed by the Constitution for the consideration of a measure, but only in case of disapproval of the opportunity to return the measure with his reasons to the House in which it originated, has signed the bill within the ten days period, of course."

Unless action is taken to question the legality of such unprecedented reading of the Constitution, and the action is supported by the courts, the bill is now law and its provisions will immediately go into force.

Under the terms of the bill, a commission, composed of the Secretary of War, the Secretary of Agriculture and the Secretary of the Interior, is authorized to lease up to fifty years the water-power rights on all public lands, forest reservations, Indian reservations and on navigable streams. At the end of the lease period, the government has the option of taking over the plants that have been built at an appraised valuation, of re-leasing them, or of leasing to any concern the commission chooses, with the lessee paying the appraised valuation.

Under no circumstances does the franchise granted in the lease become the property of private individuals or companies for the purpose of sale or disposal. Only the physical valuation is considered at the end of the lease.

Nebraska To Try Convict Labor for Grading Roads

Convict labor will be employed in grading four highways aggregating 46½ mi. in Johnson, Seward and Pawnee Counties in Nebraska. Contract prices on all four projects exceeded the estimates and the experiment with convict labor is an attempt to secure the improvements at the expenditure permitted. A wagon camp for eighteen men will be established on each project. The prisoners will work 60 hr. a week and will receive $1.50 per 10-hour day for their work and an additional 75c. a day per man will be paid to the institutions from which the men come. If the experiment with convict labor proves successful its use may be extended. The work is being directed by the state highway department.

Commercial Organizations Make Appeal for Public Utilities

Six commercial organizations in Chicago with a combined membership of 16,213, headed by the Chicago Association of Commerce, have joined in an appeal to the Illinois State Public Utility Commission urging immediate relief in the matter of rate adjustments for the various public utilities. Unless prompt action is taken, it is contended that even the present unsatisfactory public service cannot be maintained. If time is not available for an exhaustive consideration it is suggested that tentative orders be entered covering experimental or temporary periods until such time as experience or further investigation and deliberation will enable the commission to do complete and full justice.

A. A. E. Appoints Committee on Consulting Fees

Feeling that engineers in consulting practice are in need of the support of the whole profession in the matter of promulgating proper ethical relations and fees, the American Association of Engineers has appointed a committee on uniform fees and practice. The personnel is as follows: Farley Gannett, consulting engineer, Harrisburg, Pa.; A. N. Johnson, consulting highway engineer, Portland Cement Association, Chicago; C. J. Tilden, professor of engineering mechanics, Yale University; Edwin Duryea, consulting engineer, San Francisco; Langdon Pearse, sanitary engineer, Sanitary District of Chicago; Wilbur Jay Watson, chief engineer, Watson Engineering Co., Cleveland; John W. Cunningham, consulting engineer, Portland, Ore.; L. E. Ayres, principal assistant engineer with Gardner S. Williams, Ann Arbor, Mich; George W. Fuller, consulting engineer, New York City. W. L. Benham, consulting engineer, New York and Kansas City, is chairman.

Sewage Sedimentation Advised for Syracuse, New York

Plans for treating the sewage of Syracuse, N. Y., by sedimentation, with sludge disposal by pumping through a long, small force main to the Solvay plant and mixing it with industrial wastes there, have been approved by Metcalf & Eddy, consulting engineers, Boston. The plans were made by Glenn D. Holmes, engineer Syracuse Intercepting Sewer Board, after a considerable period of investigation. The consulting engineers estimate that a sedimentation plant would cost $794,300 and a fine screening plant $1,302,800. Approval is given to the omission of trickling filters, at one time seriously considered, the consulting engineers agreeing with Mr. Holmes that Onondago Lake will for many years to come afford ample dilution and oxidation to settled sewage. The plans must go to the New York State Department of Health for approval.

New York Contractors Charge Bad Faith by City

The General Contractors Association of New York City, through its secretary, C. A. Crane, has again attacked the city for its failure to settle with subway contractors who, because of what is known as the agreement of June, 1918, completed contracts involving the expenditure of approximately $7,000,000 in excess of the contract prices, such an increase being due to the sharp advance in the prices of materials and labor resulting from intensive war construction. The association has addressed the Board of Estimate and Apportionment, calling attention to the recent report of the Committee on Finance and Budget relating to the claims for supplies, materials and labor furnished the Board of Education during 1918, and alleging that "the Board of Estimate, in refusing to carry out its agreement" (as to subway work) "has swindled those who relied on its integrity."

In its report rendered May 28 the Committee on Finance and Budget, in dealing with claims for labor, materials and supplies furnished the Board of Education in 1918 for which no payment has been made because of no request to cover them, asserted that "aside from the injustice to those who have furnished property and services to the City of New York without, thus far, having been compensated, a condition has been created that reflects upon the entire City of New York and raised questions as to the good faith and fair dealing of its accredited officers." The contractors, in their letter to the Board of Estimate, wish to know if that report may be taken as in indication that they may now expect relief as implied in the agreement of June 15, 1918.

AGREEMENT OF 1918

The agreement upon which subway contractors base their claims for relief resulted from a joint meeting of the Board of Estimate and Apportionment and the Public Service Commission June 15, 1918. The text of that agreement is given herewith:

> It is the sense of the members of the Board of Estimate and Apportionment and the Public Service Commission, participating in joint conference:
>
> (1) That unfinished subway construction work shall be carried to completion forthwith;
>
> (2) That the men engaged upon the work shall receive the compensation which it is admitted is just;
>
> (3) That there should be no general cancellation of existing contracts or release of sureties;
>
> (4) That in the case of any contractor who declines to proceed in accordance with the plans hereinafter set forth, the Public Service Commission immediately proceed to complete the work under the terms of such contract, employing the necessary labor and utilizing the available plant of the contractor;
>
> (5) That contractors having claims present them forthwith for consideration and adjustment;
>
> (6) That contractors who have no claims for damage or delay and whose time for performance has not expired may have their contracts modified or supplemented upon their agreeing to complete the work within a shorter period than now required, and as a consideration to receive therefor a sum of money that will equal the cost of labor and material made necessary by the war;
>
> (7) That all agreements of any kind modifying existing contracts must be consented to by the sureties;
>
> (8) That any contractor who desires other or different relief under the Lockwood law may apply therefor without prejudice by reason of any of the foregoing on condition that he diligently continue his work.

It is alleged that approximately $7,000,000 of the contractors' own money, largely secured through credit from the banks because of the foregoing agreement, was spent in finishing contracts, and that up to now but four settlements have been made, and these totalling but $700,000.

Kentucky Highway Commission Appointed

Members of the recently organized State Highway Commission of Kentucky were sworn in June 17. The members are: Ben Weille, Paducah; Hugh Asher, Pineville; Green Garrett, Winchester; and Mr. Monohan, St. Matthews. A state primary system consisting of 3,500 mi. of road has been established and nothing but hard surfaced highways are contemplated for construction by the new highway department. There is under consideration a construction program calling for the expenditure of more than $4,000,000 during the current fiscal year.

New York City Post of Military Engineers Formed

With an attendance of from 75 to 100 men the organization meeting of the New York Post of the American Society of Military Engineers was held June 15, in the Army Building, 39 Whitehall St., New York City. The meeting was called by the Board of Directors of the parent organization. Temporary officers were elected and a temporary organizing and nominating committee appointed by the temporary chairman to draw up a constitution and by-laws and prepare a list of permanent officers to be presented at the next meeting of the local post at the same place on the afternoon of June 29.

The temporary officers elected are: President, Col. F. A. Moliter; vice-president, Col. George D. Snyder; secretary-treasurer, Major P. E. Barbour. The organizing and nominating committee is headed by Col. T. P. A. Luqueer. Col. F. A. Snyder and Lt.-Col. J. P. Hogan were named as two of the other members of the committee of five.

A number of the men present at the organization meeting are members of the parent organization. The names of all those attending were secured and the registration of each man's name was declared as equivalent to application for membership in the local post. The purposes for which the society was formed and the possibilities for building up a strong local organization were explained by Col. Edward Burr, Corps of Engineers, district engineer of the first New York district.

Cincinnati Southern To Renew Its Ohio River Bridge

(Special Correspondent)

Cincinnati, June 21—With the reconstruction of its Ohio River bridge, for which contract has just been let, the Cincinnati Southern R.R. by 1921 will have finally removed the restrictions on its traffic caused by the existence of its two weakest structures at the two ends of its main line at Cincinnati and at Chattanooga. The Chattanooga Bridge was ordered out of service by the U. S. Railroad Administration in August, 1919, since which time, up to the recent completion of the renewal work, all trains have had to make a roundabout detour to cross the Tennessee River. The Ohio River bridge has long necessitated operation with special light engines into the Cincinnati terminus.

Renewal of both structures was decided on in 1916. At Chattanooga considerable progress had been made on the substructure and a new lift span erected before the declaration of war put a stop to activities. For Cincinnati the consulting engineer, Ralph Modjeski, had completed plans for a heavy new double-track structure and tenders were about to be called for, when the work was held up. After the return of the railroads to private hands the leasing line, Cincinnati, New Orleans & Texas Pacific Ry. (Southern Ry. system) made arrangements to proceed with the Ohio River work, and the contract for furnishing and erecting the superstructure has been placed with the American Bridge Co.

Traffic and river conditions at Cincinnati require the erection of the new double-track structure without interrupting service over the old spans and without the use of falsework in the river, except for the 300-ft. span at the north shore and the lift span (which will replace the present draw span) at the south shore. This leaves a 300-ft. span to be erected by cantilevering from the north shore span and a 519-ft. span to be cantilevered from the former and from the lift span. The new steel will be erected on the old piers, with the load distributed by pier columns and pier girders, these supports being encased in a jacket of concrete after erection work is completed. Silicon steel will be used in all main truss members.

U. S. Engineer Office at Chattanooga

The United States Engineer Office at Chattannooga has been reestablished. For several years the work in the Chattanooga district has justified the maintenance of a branch office only. The new office will be in charge of Major Harold C. Fiske. At the last session of Congress a survey of the whole Tennessee River was authorized which will make Chattannooga the center of a considerable volume of engineering activity.

Salary Schedule for Engineering Educators Drafted

A letter recently sent out from national headquarters of the American Association of Engineers to 93 deans of engineering colleges, who are acting as corresponding members on the association's committee on salaries of engineers in teaching service, asks comment on the following schedule:

1. Dean, director or superintendent (reporting directly to the president and responsible as virtual vice-president and operating manager for conduct and policies of engineering department): $8,000 to $15,000.
2. Professor in charge of a department of study (reporting to the dean and responsible for the conduct of his department): $6,000 to $12,000.
3. Professor (a mature man with experience both as a teacher and in the practice of his profession) in full charge of courses of study: $5,000.
4. Special lecturer: by arrangement.
5. Associate professor or junior professor (a younger man, in line for professorship and in general capable of doing a professor's work): $4,000 to $9,000.
6. Assistant professor (of which there may be two or more grades; may have charge of laboratory, individual course of study, etc.): $3,600 to $7,500.
7. Instructor (teaching sections under general supervision of the professor in charge): $3,000 to $4,000.
8. Assistant instructor (full time): $1,800 to $2,100.
9. Assistant, either class or laboratory (part time): Monthly basis.
10. Student assistant: Hourly basis.

C. J. Tilden, professor of engineering mechanics in Yale University is chairman of the committee. The other committeemen are: Professor P. H. Daggett, Dean F. L. Bishop, Professor Frederic Bass, Dean Anson Marston, Professor George F. Swain, Dr. S. P. Capon, A. N. Johnson, Baxter L. Brown, H. Z. Osborne and Harrison P. Eddy.

River and Harbor Allotments

The current Rivers and Harbors Bill was passed as a lump sum appropriation of $12,000,000. The Chief of Engineers has announced the allotments, those over $100,000 being as follows: New York Harbor, $300,000; Passaic River, $170,000; Delaware River, $625,000; Baltimore Harbor, $110,000; Cape Fear River, $100,000; Savannah Harbor, $500,000; St. Johns River, Fla., $315,000; Tampa Bay, $260,000; Mobile Harbor, $200,000; Warrior Rivers, $120,000; Pascagoula Harbor, $100,000; Gulfport Harbor, $100,000; Southwest Pass, Mississippi River, $800,000; Houston Ship Channel, $300,000; Freeport, Tex., Harbor, $100,000; Mississippi River, $900,000; Missouri River, $200,000; Calumet, Ill., Harbor, $130,000; Oakland, Cal., Harbor, $200,000; Sacramento, River, $100,000; Coos Bay, Ore., $125,000; Columbia River, $226,000 and San Juan, P. R., Harbor $200,000.

Idaho Highway Program Large

Between April, 1919, and April, 1920, the Bureau of Highways of Idaho awarded contracts amounting to $2 903.228.09 and co-operated with the United States Forest Service on six contracts amounting to $735,222.20. In addition to the work now under contract, about $4,000,000 worth of work will be awarded up to July 1.

California Highway Work Stopped Pending Court Decision

State highway day labor work, authorized or under way, approximating $1,000,000 in estimated value, has been ordered discontinued by the California Highway Commission. Such action followed its previous order disbanding all survey parties engaged in locating surveys on new and uncompleted routes. These actions are a continuation of the policy of the commission inaugurated several months ago to curtail work pending readjustment necessary to make the state highway 4½ per cent bonds salable at par. All contract work and a limited amount of day labor work will be continued for the present. Work has been ordered stopped on thirty projects in twenty-one counties of the state.

Court proceedings were recently instituted by the former secretary of the State Highway Commission, W. R. Ellis, to prevent the State Highway Commission from using Federal-aid highway funds for the purpose of paying discounts on highway bonds that otherwise are unsalable, inasmuch as the California law prescribes that highway bonds be sold at par and that they shall not bear more than 4½ per cent interest. Prior to the adoption of this method of meeting the emergency, caused by the inability of the Highway Department to sell their 4½ per cent bonds at par, the legality of the method was confirmed by Attorney-General Webb, and by the fiscal agents of the state, according to a bulletin recently issued by the California State Highway Commission. It is the belief of that commission that the method conforms not only to the letter of the law but to its spirit. The commission based its belief upon the judgment that the Federal money constitutes not a construction fund but a reimbursement fund, the United States Government saying, in effect, to the states that if they will construct roads to meet Federal requirements as to specifications, the United States Government will repay the state up to half of the cost of such roads within the amounts allotted to the various states.

Commenting upon the mandamus proceedings instituted by Mr. Ellis, which have effectually tied up highway work at least pending the final decision of the court, the State Highway Commission says that "the purpose of the present action is undoubtedly simply to harrass the commission, and it is but another phase of the guerrilla warfare that the former secretary of the commission has conducted both within and without the highway department since the refusal of the commission to increase his salary." The action is holding up payrolls, and the real sufferers are the employees of the commission, contractors, and others who are entitled to payment now for services rendered to the state.

Of thirty-two surveying crews on location work, all but nine have been ordered discontinued. The only new contracts undertaken within the past few months, or that will be undertaken, are those which the counties have asked to finance by purchasing highway bonds at par. These are comparatively few in number and all belong to that class of highway which properly can be considered of paramount importance.

Court Restricts Flow of Lake to Chicago Drainage Canal

Withdrawal of water from Lake Michigan for the Chicago drainage canal is restricted to 250,000 cu.ft. per minute by a decision just handed down by Judge K. M. Landis in the U. S. District Court at Chicago, but the Sanitary District of Chicago will carry the case to the U. S. Supreme Court. The case has been in litigation for several years, the claim of the War Department being that the draft from the lake has lowered the level of all the Great Lakes except Lake Superior. It is upon this condition, and the consequent necessity of protecting navigation, that the present decision is based. Two methods of overcoming the difficulty are under consideration, one being the treatment of sewage before its discharge into the canal and the other being the construction of controlling works to regulate the flow from the eastern outlet of the Great Lakes, as described in *Engineering News-Record* of Feb. 12, 1920, p. 308.

Another Concrete Ship Ashore

In the latter part of May the concrete tanker "Selma," a 7,500-ton ship built for the United States Emergency Fleet Corporation by Fred T. Ley & Co. at Mobile, Ala., was wrecked by running on the rocks at the outer breakwater at Tampico, Mex. Details of the accident are not available, although it is reported that there was no pilot aboard and that the navigation of the ship was not all that it should have been. The bottom of the "Selma," according to reports, is damaged to a considerable extent forward of the bridge deck, but the diver's report indicates that the structural framework of the boat has not been appreciably weakened. A representative of the Shipping Board has been sent to Tampico to supervise temporary repairs. The boat has been successfully pulled off the breakwater and is now resting on a mud flat nearby. After temporary repairs are made the boat will be brought to Galveston for permanent repairs. One of the Shipping Board's steel boats, the "John D. Rockefeller, Jr.," was wrecked several months ago very close to the place where the "Selma" went aground and a wrecking crew has been working without success ever since in an effort to float the boat.

It has been rumored that the "Latham," the other 7,500-ton concrete tanker built at Mobile had been wrecked and sunk, but this is not a fact. The "Latham" docked June 16 at Philadelphia.

Contractors Circulate Car Shortage Questionnaire

Believing that the right of construction materials to transportation is subordinate only to food and fuel, the Associated General Contractors of America will attempt to make the Interstate Commerce Commission see that right through the interpretation of figures which the association is asking for in a questionnaire recently issued from the office of the secretary. Contractors are asked if they favor an effort on the part of the Associated General Contractors to secure priority for construction materials over less essential commodities, and what conditions or facts in each locality prove the need for giving construction materials preference over all other commodities other than food and fuel. They are also requested to report if work is being delayed because of car shortages by naming contracts delayed, with approximate values. They are also asked to report upon what types of cars are needed, how many daily, where, and what percentage of cars as compared with requirements has been received in the ten-day period prior to the time of reporting.

Canadian Government to Purchase Railroad Lines

It has been announced that the Canadian Government has appropriated $518,000 for the purchase of the following railroads: Elgin & Havelock, York & Carleton, St. Martin's, Salisbury & Albert, Moncton & Buchouche, Kent Northern and Caraquet & North Shore.

Road Equipment Bill Fails

Hope had been entertained that the bill turning over tractors, mobile machine shop units and other equipment for road building purposes would be among those signed by the President within the ten-day period, in which the Attorney General has ruled he might sign bills despite the adjournment of Congress. This was not the case, however, and the measure was lost.

Gen. Goethals In Engineering and Construction Firm

Announcement has been made of the formation of the new engineering firm of Goethals, Wells & Co., Inc., with offices at 150 Nassau St., New York City. The officers are Major General George W. Goethals, president, and George M. Wells, Henry Goldmark and James L. Ward, vice-presidents. Mr. Wells and Mr. Goldmark were both associated with General Goethals on the Isthmus and have been connected with the consulting engineering firm of George W. Goethals & Co., Inc., which firm will continue as consulting engineers and managers of corporations. The new firm will carry on a general engineering and construction business, specializing in the engineering and architectural design of all classes of structures and their construction.

Indiana Raises Partial Payments On Road Construction

The reorganization of the Indiana Highway Commission was effected June 16 in Indianapolis, at which time it was decided that the commission advance to contractors building state highways 100 per cent of the contract price per mile on the completion of each mile of road. The advance is not to be regarded as final until the entire contract is completed. Heretofore the limit was 80 per cent. The change was effected after a conference the commission held with contractors who have been considerably agitated over their contracts. The commission declined to lower gravel standards as proposed by some.

Money Tight for Indiana Road Contractors

State highway contractors held a conference in Indianapolis June 15 to discuss ways and means by which to finance the hundreds of thousands of dollars worth of contracts they have. They are disturbed because banks are unwilling to let them have much money and because they must pay 7 per cent interest. It has been suggested to L. H. Wright, director of the state highway department, that the state advance them more money, especially for cement. Mr. Wright was at the conference, which was attended by representatives of all the eighteen projects now under construction.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Portland, Ore., Aug. 10-12.

AMERICAN PUBLIC HEALTH ASSOCIATION, Boston; San Francisco, Sept. 13-17.

The New Jersey State Association of County Engineers will hold its quarterly meeting June 25-26, at the Hotel Mannahassett, Seaside Park, N. J.

The Western Society of Engineers, at its meeting of June 14, heard two papers on the Chicago River bridges by engineers of the Department of Public Works; one by Clarence S. Rowe on "Construction Methods," and the other by Fred H. Avery on "Repair and Maintainenance Methods." The latter paper outlined some of the difficult work involved in the maintenance of bascule bridges and in the repair of superannuated swing-bridges that must be kept in service until funds for reconstruction can be obtained.

The Colorado Society of Engineers has joined the Denver Civic and Commercial Association. R. M. Hosea, president, has been named as the society representative.

The Grand Rapids (Mich.) Engineering Society elected the following officers at its annual meeting held May 28: President, Henry H. Turner; vice-president, W. A. Sperry; secretary, Major Burritt A. Parks; directors, G. W. Wagner and Daniel W. Kimball.

The Buffalo (N. Y.) Engineering Society is formulating plans to take an active interest in all civic affairs, paying special attention to engineering problems confronting the city, according to a recent announcement by President William B. Powell. Speakers of national repute will discuss engineering problems at the monthly meetings during the coming fall and winter. A close study will be made of the engineering problems in connection with the development of additional power at Niagara Falls, the development of the Erie barge canal terminal, the electrification of the steam railroads entering Buffalo, the bridge across the Niagara River at Buffalo, the canalization of the St. Lawrence River, the widening of the Niagara River at Buffalo and the industrial geography of the American Niagara frontier.

The Tri-State Water and Light Association, at its meeting held at Atlanta, Ga., May 21, elected the following officers for the ensuing year: President, A. A. Passolt, Newnan, Ga.; first vice-president, E. P. Meredith, Tarboro, N. C.; second vice-president, J. E. Gibson, Charleston, S. C.; third vice-president, D. L. Caston, Gainsville, Ga.; secretary and treasurer (reelected), W. F. Stieglitz, Columbia, S. C.

PERSONAL NOTES

F. A. Swingle and Gordon H. Taylor, of Kennewick, Wash., have formed a partnership and will engage in structural and engineering work, with offices in that city.

DeWitt O'Dell has resigned from the engineering department of the Power Specialty Co., Dansville, N. Y., and has been appointed assistant engineer in the State Engineer's Department, with headquarters in Rochester.

George Douglas Mackie, city engineer-commissioner of Moose Jaw, Sask., has been appointed to represent that city on the Saskatchewan Water Supply Advisory Council.

J. W. Johnston, for the past two years district engineer in charge of the Portland Cement Association's office at Parkersburg, W. Va., has been appointed district engineer in charge of its Milwaukee office. Previous to his connection with the association, Mr. Johnston was city engineer of Sioux Falls and engineer of Minnehaha County, S. D. J. H. Riddle, who has been in the Parkersburg office since 1916, becomes district engineer of that office, succeeding Mr. Johnston. Mr. Riddle was formerly engineer of Roane County, W. Va.

William Wells, civil engineer, of Rensselaer, N. Y., has been appointed to investigate the city's water supply problem.

Dr. W. H. Ellis, formerly dean of engineering and applied science at Toronto University, was presented, May 13, with the gold badge of honorary membership in the Engineering Institute of Canada, at a meeting of the Toronto branch, as a tribute to long and distinguished service in connection with the engineering profession.

B. E. Gray has been promoted from the position of Federal highway engineer to that of senior highway engineer of West Virginia.

John S. Brown, U. S. Geological Survey, has just completed an investigation of the water supply on several of the Florida keys for the U. S. Public Health Service.

The McClaskey & Reese Engineering Co., has opened offices in Canton, Ohio, and will engage in general engineering. Mr. McClaskey was formerly resident engineer for the firm of R. Winthrop Pratt, Cleveland, and Mr. Reese, who has been connected with the Canton water-works for the last five years, was assistant to the superintendent.

John E. Foote has resigned as city engineer of Little Falls, N. Y.

Richard K. Lynt has been transferred from the International Boundary Commission to the U. S. Geological Survey to do topographic mapping of a part of Admiralty Island in connection with a pulp wood investigation.

F. F. Miller has resigned as assistant engineer of the Semet-Solvay Co., Chicago, to accept the appointment of city engineer of New Castle, Pa. He succeeds M. H. Milholland, who has established civil engineering offices in that city.

Henry V. Macksey, who recently resigned as superintendent of public works of Woburn, Mass., has been appointed superintendent of public works of Framingham, Mass.

W. A. Hardenbergh has resigned as assistant sanitary engineer, United States Public Health Service, to become consulting engineer and southern manager, Chemical Toilet Corporation, Syracuse, N. Y.

John R. Spelman, civil engineer, New York, has been appointed consulting and resident engineer to assist W. Fred Starks, engineer of Nassau County, N. Y., in the preparation of plans, specifications and supervision for the construction of the Long Beach Bridge.

Colonel George L. Watson, formerly member of the General Staff Corps, U. S. A., and assistant chief of staff, G. 2, Third Army, has been appointed a member of the board of consulting engineers of the New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission.

R. A. Harbaugh, recently estimating engineer of the Pittsburgh Filter & Engineering Co., has accepted a position in Detroit with the Ford Motor Co.

John Lansdale has been appointed valuation engineer, succeeding I. A. Cottingham, and C. N. Campbell has been appointed assistant valuation engineer, of the Southern Pacific Lines in Texas and Louisiana. Major Lansdale, during his service with the A. E. F. in France, was in charge under the Director of Construction and Forestry, of the railroad and dock section and it was under his immediate supervision that the construction on the Nevers cut off and Loire River bridge was carried out.

John P. Collins, former superintendent of construction of the McNichol Paving & Construction Co., of Philadelphia, has been made president of the Peninsula Construction Co., Bridgeton, Del.

Henry E. Gabriels, recently in the engineering department of the Watervliet (N. Y.) Arsenal, has been appointed city manager of Watervliet.

Charles M. Moorefield, formerly district engineer of the U. S. Bureau of Public Roads in the South, has been appointed chief engineer of the South Carolina State Highway Department.

J. B. Easter was recently appointed district engineer of the 6th State Road District of New Mexico, with headquarters at Santa Rosa, N. M.

Major L. M. Adams, Corps of Engineers, U. S. A., has left Camp Humphries, Va., where he has been an officer in the School of Engineers, to take up his new duties as chief of the Galveston (Tex.) engineering district. He relieves Colonel Spencer Cosby, who has been transferred to Savannah.

John F. Druar and Roscoe Smith, who have been associated for the past year as consulting municipal engineers under the firm name of Druar & Smith, St. Paul, Minn., have dissolved partnership. The work of the firm will be continued by Mr. Druar. Mr. Smith has entered the employ of the National Board of Fire Underwriters at New Orleans, La.

G. F. Richan, of Winnipeg, has been nominated hydraulic engineer, W. C. Warren, of Ottawa, has been nominated junior hydraulic engineer, and N. Moore, of Calgary, junior irrigation engineer, of the Canadian Reclamation Service, Ottawa.

Major C. L. Hall, assistant engineer of the Galveston engineering district, has been transferred to Washington, D. C., where he will be assigned as assistant to the Chief of Engineers.

Henry S. Spackman has retired from the Henry S. Spackman Engineering Co., and the name of the company has been changed to E. L. Conwell & Co., Inc. Mr. Spackman will continue, as heretofore, his engineering practice, with offices at 2024 Arch St., Philadelphia.

Ralph Hilscher, formerly Southern division engineer of the California State Board of Health, has recently been appointed director of the Bureau of Sanitary Engineering of the Board, succeeding C. G. Gillespie. Mr. Hilscher's headquarters are in Berkeley.

W. G. Chace has resigned as chief engineer of the Greater Winnipeg Water District, which was created in 1913 for the purpose of bringing by gravity a supply of water from the Lake of the Woods to the city of Winnipeg and vicinity. Mr. Chace has recently organized Research & Development, Ltd., a Manitoba corporation which proposes actively to initiate new industries for Manitoba based on the resources of that district and on such other commercial enterprises as may offer opportunity of success.

Milton Ruggles, consulting engineer, Stamford, Conn., has been retained by B. F. Perkins & Son, Inc., Holyoke, Mass., as chief engineer on the construction of their new manufacturing plant to be erected at Willamansett, Mass.

A. Burton Cohen has resigned as concrete engineer for the Delaware, Lackawanna & Western R.R. to enter private practice as a consulting engineer, specializing in reinforced-concrete design and construction, and bridges, buildings and railroad structures. His office will be at 1 Madison Ave., New York City. Mr. Cohen is a graduate in civil engineering of Purdue University and has been for a number of years connected with the Lackawanna R.R., particularly in the design and construction of the numerous concrete bridge and railroad structures in which that railroad has specialized in the last ten years. In his new capacity he has been appointed consulting engineer in design and construction of the Harrison Ave. bridge at Scranton, Pa., and has also a commission from the city of Corning, N. Y., to design and construct the new Pine St. bridge over the Chemung River.

Henry E. Wolff, city engineer of Winona, Minn., has resigned that position to enter private practice. He has been succeeded by Earl E. Chadwick, formerly with the Department of Public Works, Minneapolis.

Joseph D. Williams, of the city engineering department, has been appointed city engineer of New Britain, Conn., succeeding William H. Hall.

Morris Bien, assistant to the director, U. S. Reclamation Service, has been advanced to the newly created position of assistant director.

C. C. Smith, city engineer of San Angelo, Tex., has resigned to enter the highway contracting business as a member of the firm of Smith & Hicks, of Hillsboro, Tex.

H. R. Safford, since the return of the railroads to private control executive assistant to President Hale Holden of the Burlington Lines, received, on June 9, from Purdue University the honorary degree of Doctor of Engineering.

Howard Stillwell, formerly with the Solomon Norcross Co., Atlanta, has been appointed city manager of Sumter, S. C.

OBITUARY

John Scullin, chairman of the board of directors of the Scullin Steel Co., retired railroad operator, died in St. Louis, May 28, at the age of eighty-four. He had charge of construction of a considerable portion of the Missouri, Kansas & Texas line, and engaged in contract work on part of the present St. Paul, Union Pacific and Rock Island systems. He promoted the old horse-car lines in St. Louis, and later the electric lines. He was the founder of the Scullin Steel Co.

Claude Parmer, vice-president of the Kuert Contracting Co., Indianapolis, died recently. Mr. Parmer, who was thirty-four years old, served two years in the Corps of Engineers, U. S. A., in France.

Samuel Flory, founder and general manager of the S. Flory Manufacturing Co., Bangor, Pa., died recently in that city at 66 years of age. He was born in Plainfield, Pa., in 1854. About forty-five years ago Mr. Flory founded the manufacturing plant which bears his name, and operated it personally for ten years. He then organized the S. Flory Co., and in 1897 the S. Flory Manufacturing Co. was incorporated. Mr. Flory was widely known as the originator of the suspension cableway system manufactured by the company, which has been in successful operation in the slate, coal and quarry regions of the United States for more than forty years.

Charles H. Vinal, construction manager of the Allis-Chalmers Co., died at Little Muskego Lake, Wis., June 12. He was born at Keokuk, Iowa, in 1858. In 1875 he became locating engineer for the Milwaukee, Lake Shore & Western Ry., under his uncle, H. G. Reed, at that time general manager of the line, and located the road north from New London to Rhinelander and Ashland, Wis. He was appointed city engineer of Appleton, Wis., in 1890, and later was secretary and treasurer of the Hackworthy Construction Co. In 1914 he became associated with the Allis-Chalmers Co.

Whitfield P. Pressinger, of New York, vice-president of the Chicago Pneumatic Tool Co., died June 10. Mr. Pressinger was engaged in the pneumatic tool and allied machinery industry for many years, and was general manager of the Clayton Air Compressor Co. for seven years.

BUSINESS NOTES

The Chicago Pneumatic Tool Co., New York, announces the election of Allan E. Goodhue as vice-president in charge of sales. For the past year Mr. Goodhue has been managing director of the company's English subsidiary, the Consolidated Pneumatic Tool Co., London, and director of European sales for the Chicago Pneumatic Tool Co. During the war he was assistant manager of the Steel and Raw Material Section, Production Division, Emergency Fleet Corporation. He is expected to arrive in this country about the first of July.

B. G. Prytz has resigned as president of the SKF Industries, Inc., New York City, having been elected managing director of the parent company with headquarters at Gothenburg, Sweden. Mr. F. B. Kirkbride, vice-president since the organization of the company, has been elected president.

The American Manganese Steel Co., announces that Walter Brinton, for the past several years manager of its New Castle, Del., plant has been elected vice-president.

Carl Wigtel, vice-president and chief engineer of the Watson-Stillman Co., sailed, June 14, for a ten weeks' trip to the Scandinavian countries, expecting to visit England, France, Belgium and Holland. Since his connection with the company thirty-three years ago this is his first trip to his home in Norway. He will also investigate new developments in the line of hydraulic machinery in the above-named countries.

The Yale & Towne Manufacturing Co., Stamford, Conn., has accepted the resignation of John B. Milliken as treasurer. He will be suceceded by Willard L. Case, formerly advisory engineer to the Audit Co. of New York and recently consulting industrial engineer. Edward C. Waldvogel, for the past four years general manager, in charge of all sales and advertising, has been elected a director of the company.

The Winther Motor Truck Co., Kenosha, Wis., is making a large addition to its present plant, which is expected to be ready for occupancy by Sept. 1. The new structure is 60 x 400 ft., and up to date in construction and labor-saving and safety appliances. The company expects to double its present output with the new manufacturing space.

Allan Fraser, formerly sales manager at Buffalo of the American Steel & Wire Co., and more recently Eastern sales manager and assistant general sales manager of the Wickwire Steel Corporation, Worcester, Mass., has been made general sales manager of the corporation, with headquarters at Worcester.

Volume 84 New York, June 24, 1920 *Number* 26

Engineering News-Record

A CONSOLIDATION OF ENGINEERING NEWS AND ENGINEERING RECORD.
WITH WHICH IS INCORPORATED THE CONTRACTOR

E. J. MEHREN, *Editor*

Precast Concrete Roof Trusses in Panama Pier Shed 1232
By G. W. True.
Discussion of the Feasibility of concrete roof trusses with comparisons of cost data between two similar sheds, one with reinforced-concrete roof trusses and one of structural steel.
Engineering News-Record, June 24, 1920. 13¼ cols. Ill.

Recommended Grade Elevation at Galveston 1238
Engineering News-Record, June 24, 1920. ¾ col.

The Need for an Endowed American Hydraulic Laboratory 1239
As Shown by Clemens Herschel, Consulting Engineer, New York City, in his St. Louis Weir-test paper and in an interview with a representative of *Engineering News-Record.*
Engineering News-Record, June 24, 1920. 4½ cols.

Articulated Concrete Barge for Dredge Crane 1241
Engineering News-Record, June 24, 1920. ½ col. Ill.

Chicago Plan Commission Report on Ten-Year Activities 1241
Engineering News-Record, June 24, 1920. 1col.

The Professional Spirit in Engineering Education 1242
By C. R. Mann.
An Opportunity for Service.
Engineering News-Record, June 24, 1920. 4½ cols.

Organic Impurities Injure Concrete 1244
Engineering News-Record, June 24, 1920. 1 col.

Recommends Study of New Terminal for Hudson Bay Railroad 1244
Engineering News-Record, June 24, 1920. ¾ col.

Mare Island Pontoon Crane of 150-Ton Capacity 1245
Heavy Structural features include 1,000-ton step bearing and long luffing screws without intermediate bearing—205 tons lifted in test.
Engineering News-Record, June 24, 1920. 6½ cols. Ill.

Hydro-Electric Power Development Begins in Nova Scotia 1248
Provincial Government to control power through commission—Initial project just started near Halifax.
Engineering News-Record, June 24, 1920. 1½ cols.

Nomographic Solution of Cubic Equation 1249
By S. Okabe.
Engineering News-Record, June 24, 1920. 1¾ cols. Ill.

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How Other Professions Than Engineering Are Organized 1250
By Charles Whiting Baker.
Some of the Methods employed by Lawyers, doctors and Architects to secure united action by large memberships.
Engineering News-Record, June 24, 1920. 6½ cols.

Crossover Practice 1254
By Francis C. Shenehon.
An Argument on the issues of the Pittsburgh Bridge Case.
Engineering News-Record, June 24, 1920. 2 cols.

Reinforcing Concrete Pavements on California Highways 1255
Transverse Bars used to prevent cracks from widening and to maintain surface continuity.
Engineering News-Record, June 24, 1920. 1¾ cols. Ill.

Shrinkage of Loosely Filled Earthwork in Embankments 1256
By E. E. R. Tratman.
Distinction Between shrinkage and reduction in volume—Varied opinions and few reliable records indicate need of study and experiment.
Engineering News-Record, June 24, 1920. 8¼ cols.

Railway Wages and Labor Efficiency 1260
Engineering News-Record, June 24, 1920. ½ col.

Freight Rates and the Railway Problem 1260
Engineering News-Record, June 24, 1920. 1 col.

New Code of Ethics for Mechanical Engineers 1261
Engineering News-Record, June 24, 1920. 1 col.

Rubble Breakwater Deposited from Railway on Ice 1261
Engineering News-Record, June 24, 1920. 3½ cols. Ill.

Tests Show Effect of Storage on Cement Strength 1263
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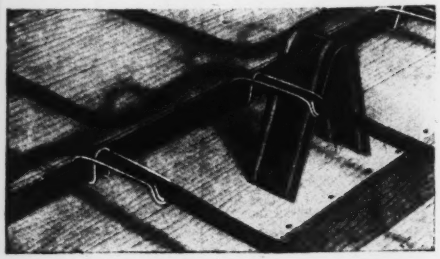
Further insures this added strength, in that the steel is evenly supported, accurately spaced and securely held in designed position.

When by using automatic spacing devices the builder can more quickly and cheaply carry out the designer's idea, is it not worth while to give the matter consideration, especially at the present cost of labor?



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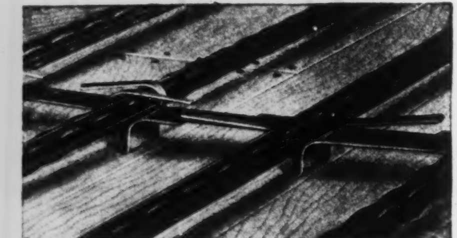
For supporting head rods over column heads and for over direct bands in flat slab and bent bars over beams in beam and girder construction.



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For supporting and spacing bars in the slab.

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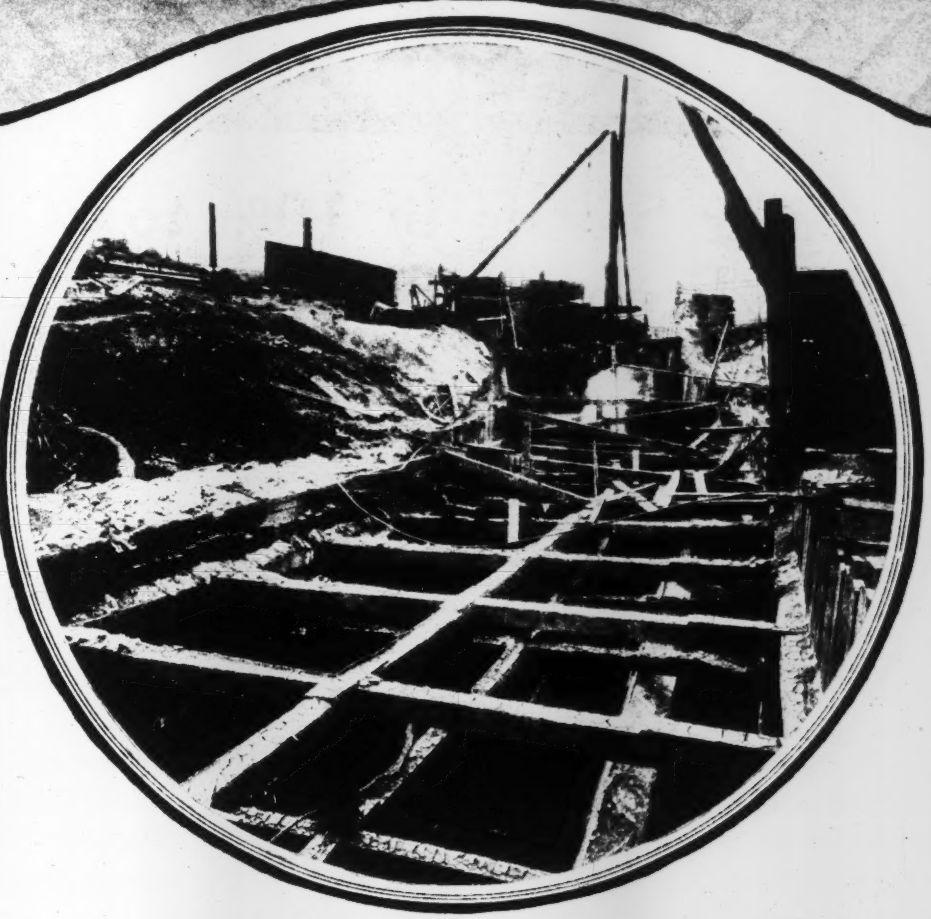

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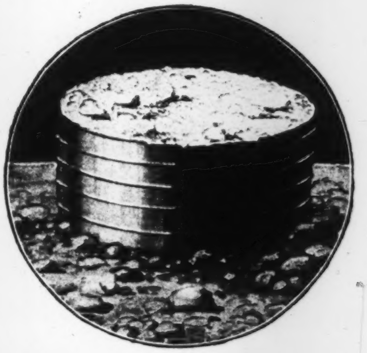
Difficult Foundation Work



in reinforced concrete, that may or may not involve the use of concrete piling, is also part of the activities of this organization. We specialize in special concrete work of any nature whatsoever.

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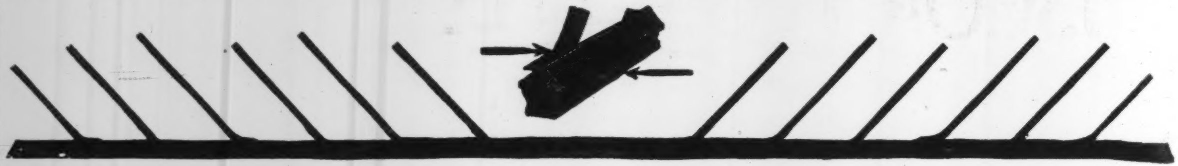

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You can do as we have done in many actual cases. Take a beam identical in all concrete sizes and design it with two types of reinforcement. In the first beam use loose stirrups combined with bent and straight bars. In the other design use Kahn Trussed Bars combined with bent bars.

Figure the cost of steel in place in both cases. You will find a clear saving of 10% to 20% in favor of the beam reinforced with Kahn Trussed Bars. The reasons for this saving are at once apparent, as follows:

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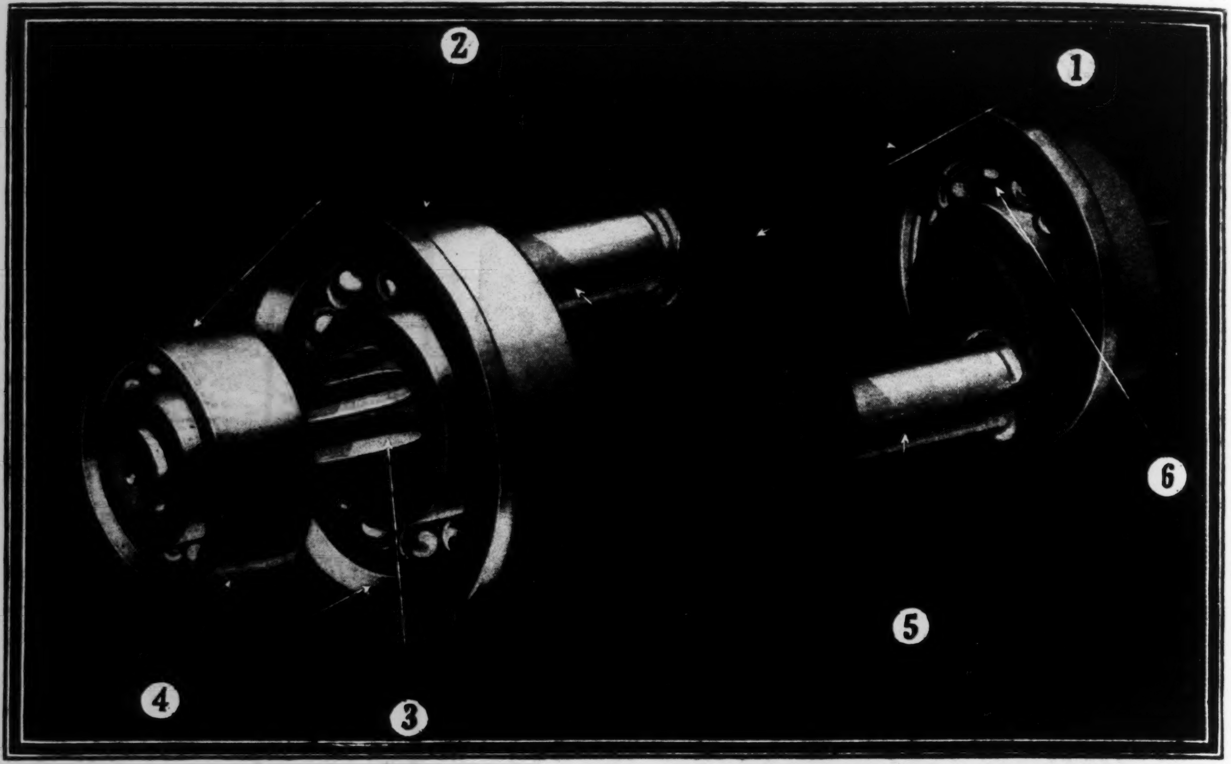

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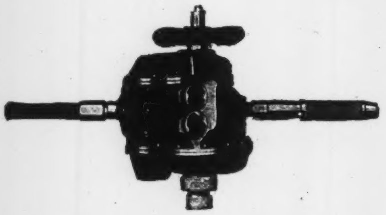

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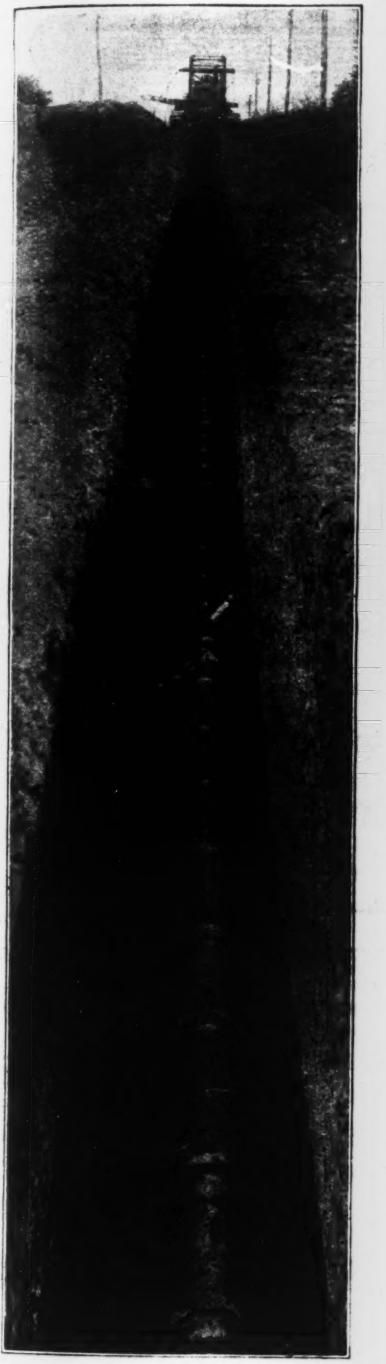

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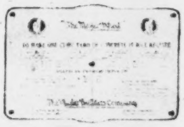
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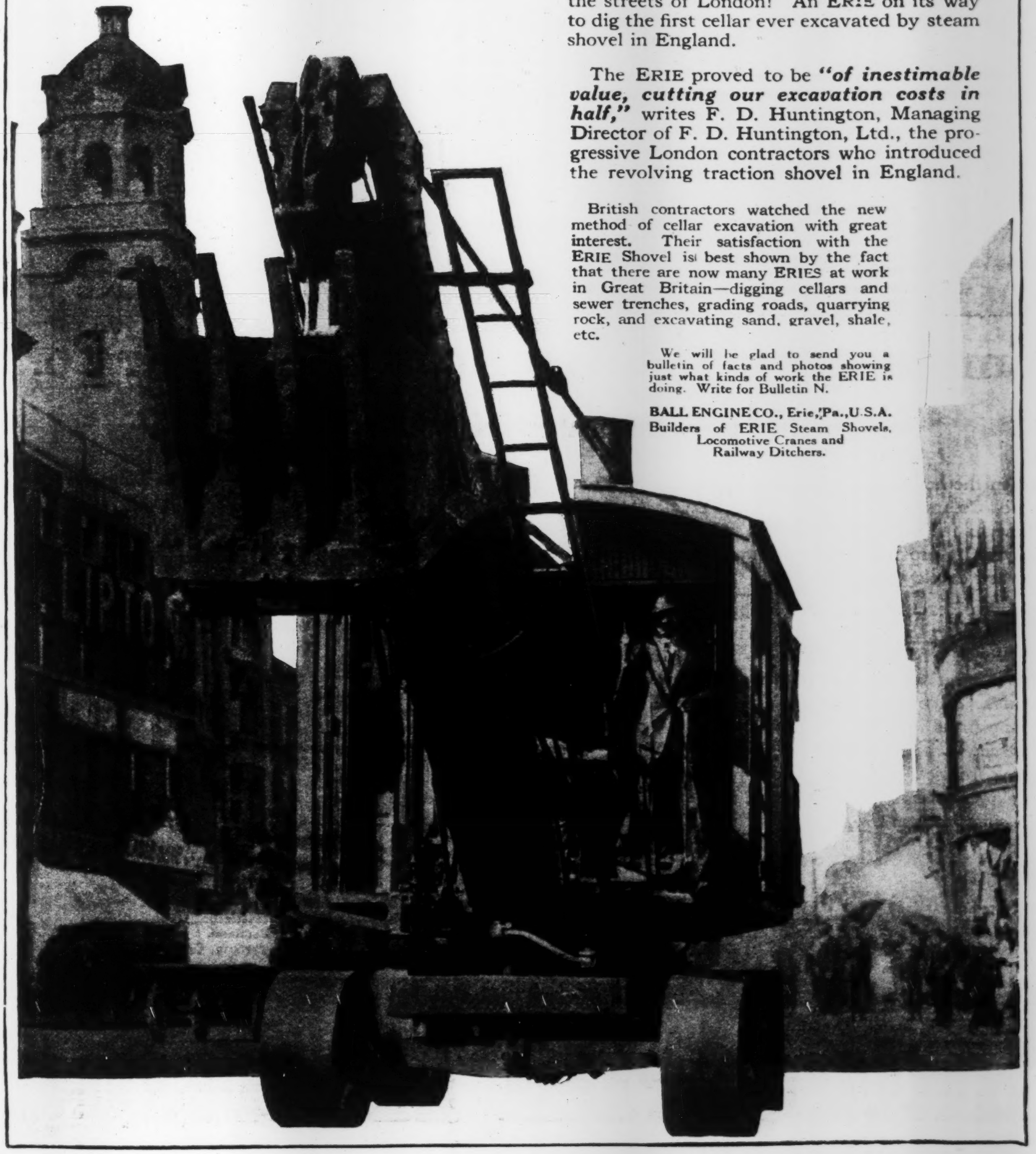

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Employees of the American Beet Sugar Co. Get Aladdin Readi-cut Houses

When the housing shortage made itself felt at Rocky Ford, Colorado, the American Beet Sugar Company came to the aid of its foremen and high grade employees by providing suitable quarters for them close to their employment.

Aladdin Readi-Cut homes were purchased because of the quality and many other advantages connected therewith. ***Since the initial order for houses was completed additional orders for more Aladdin houses have been received from this customer.*** Many firms will find it advantageous to take similar interest in housing their employees. For obtaining quick service, guaranteed complete delivery, best quality material and all-round satisfaction, bring that housing problem to Aladdin.

When you are ready to consider your housing problem bear these facts in mind.

Aladdin—

—expedites your building project—
—houses your men well and quickly—
—saves 18% of the cost of lumber—
—saves 30% of the labor cost—
—reduces the skilled labor required—
—guarantees complete shipment of material—
—guarantees the quality—
—carries material for 1,000 houses in stock—
—ships from the nearest timber region—
—quotes definite prices on any order from one house up to a city of 3,000, including churches, schools, offices, water and sewage systems, electric plants, street and house lights, heating plants, street parks, trees, lawns, etc., complete.

Write, wire or phone for Aladdin catalog No. 1555

The Aladdin Co. ***Offices and Mills at***

Bay City, Mich.
Wilmington, N. C.
Hattiesburg, Miss.
Portland, Ore.
Toronto, Ont.

ALADDIN READI-CUT HOUSES Sold By The GOLDEN RULE

Industrial Housing

Ransome CANNIFF Pneumatic Concrete Mixer and Placer

RANSOME
REG. U.S. PAT. OFF.
AMERICA FIRST

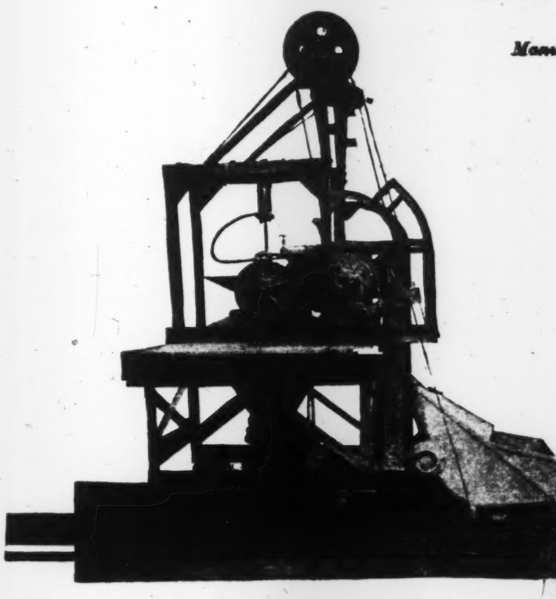
Primarily a tunnel lining machine is also often used to advantage on heavy foundations, piers, viaducts, bridges, dams and dry docks.

Engineers' tests showed that concrete placed by Ransome-Canniff machines stood 800 lbs. more pressure per square inch than did hand-placed concrete. On an average job of tunnel-lining, a Ransome-Canniff Pneumatic Concrete Mixer and Placer will mix and place concrete at less than 40% of the cost of doing the same work with mechanical mixers and placing by hand.

On railroad work Ransome-Canniff Pneumatics have a field of their own. On any job, where Ransome engineers recommend it, the satisfactory operation of Ransome-Canniff pneumatic mixers and placers is guaranteed without any qualifications whatsoever.

RANSOME CONCRETE MACHINERY CO.
1750 Second Street, Dunellen, N. J.
Manufacturers of Mixers, Pavers, Pneumatic Mixers, Chuting Plants, Hoist Buckets, Bins, Cars, Carts, Etc.

31-148



Ransome Concrete Machinery Co.
RANSOME-CANNIFF PNEUMATIC CONCRETE MIXER AND PLACER

The illustration above shows a Ransome-Canniff Pneumatic Concrete Mixer and Placer as designed for special hydro-electric development work in Japan. At the right is the mixer as shown in the new Ransome Bulletin, No. 105, Pneumatic Concrete and Grout Mixers and Placers. If you do tunnel work, you need a copy.

WHITLOCK
Guaranteed
CORDAGE

The word "Guaranteed" as applied to Whitlock ALL-Manila Rope means

Guaranteed Superior to
Government Standards

—Higher grade Fibre
—Superior Strength
—Less Tare
—Greater Yardage
than required by the
Bureau of Standards Specifications.

We also guarantee complete satisfaction to dealer and user.

"Either you are satisfied or we are not"

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COMPANY

46 South Street, New York

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Branches:
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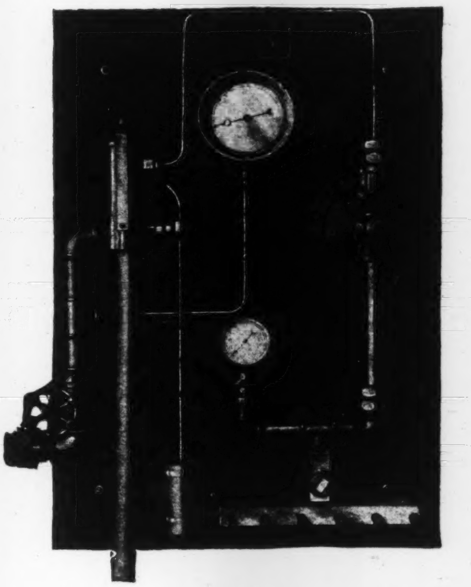
and KANSAS CITY

At Paper Mills



Type of "W & T" apparatus used in making bleaching solutions for paper manufacture

W & T Equipment

is used not only to control Liquid Chlorine (the 100 per cent sterilizing agent) for the sterilization of drinking water or the disinfection of sewage, but it is also used in the manufacture of bleaching solutions.

A Bleach made from Liquid Chlorine by "W & T" apparatus is less expensive than when made from Chloride of Lime—gives a better color—a stronger fibre, and eliminates all of the untidiness, inaccuracies, and disagreeable features of the older process.

Many satisfied users testify to the value of "W & T" equipment in this field. Paper manufacturers may submit their bleaching problems to us with assurance that recommendations will be made and quotations submitted without obligation only after detailed study of each individual problem has been made by our representatives.

Wallace & Tiernan Co., Inc.
349 Broadway New York
Philadelphia Chicago San Francisco Pittsburgh
Dallas Kansas City Atlanta

LOCOMOTIVE CRANES
CLAM SHELL BUCKETS - SHIPBUILDING CRANES
CAR DUMPERS PILE DRIVERS
THE McMYLER INTERSTATE CO.
CLEVELAND OHIO

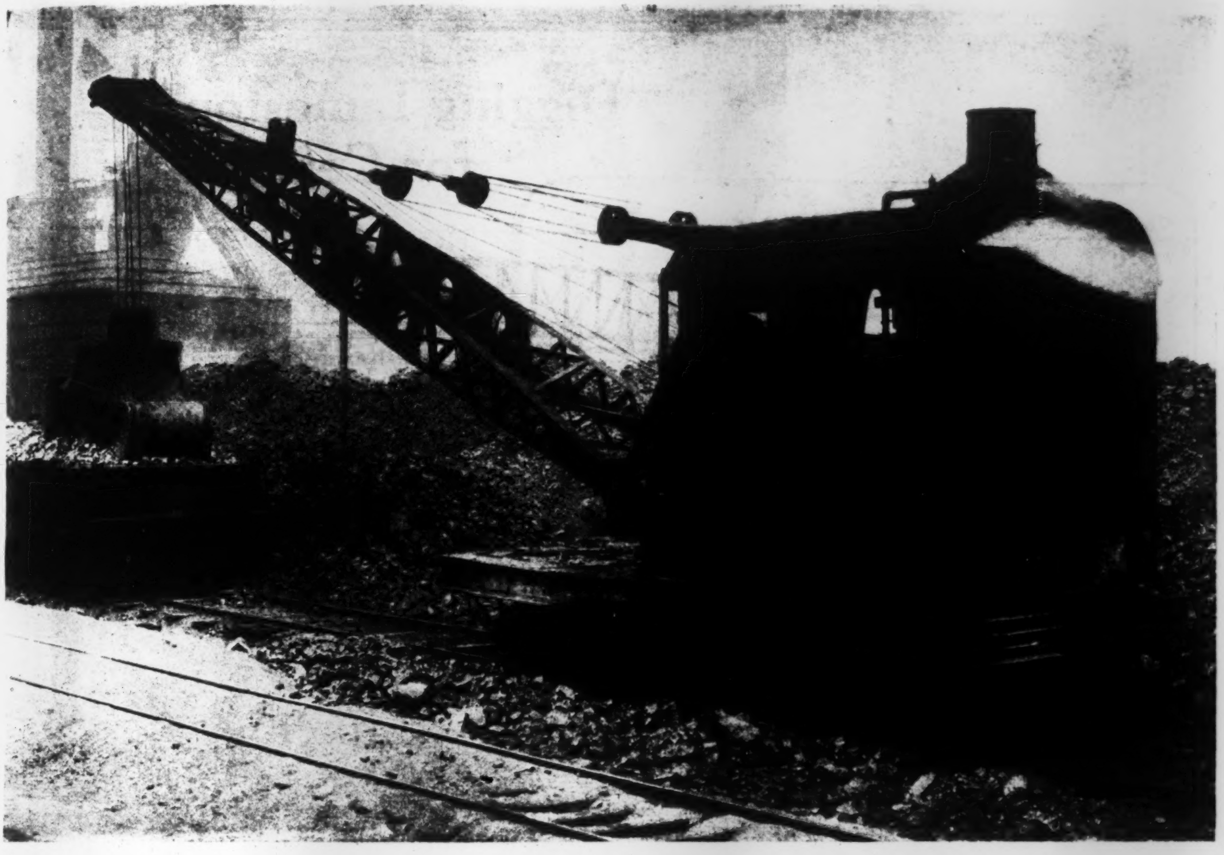
A Good Crane Has Unlimited Possibilities

Taken all-in-all, a well designed, well built locomotive crane is one of the very best all-round investments for any contractor. It has so many possibilities of handling such a *variety* of work on a job of any size that it pays to be even *over-particular* as to whose make you get. There are *many* good cranes on the market—but for a good crane plus *expert engineering service* based upon years of experience with this type of equipment we strongly urge you to consult us. There are so many questions of type, size and capacity that require accurate data—and this we are peculiarly in a position to supply.

Tell us about the size crane you want and the work, in general, it will be called on to handle, and we will tell you the type best suited.

The McMyler Interstate Company, Cleveland, Ohio

Branch Offices: New York City, 1756 Hudson Terminal Bldg.; Chicago, Ill., 812 Edison Bldg.; Seattle, Wash., Hoge Bldg.; Denver, Colo., 18th and Wazee Sts.; San Francisco, Calif., 407 Merchants' Exchange Bldg.; New Orleans, La., Howard St.; Birmingham, Ala., Brown-Marx Bldg.



Reduce Your Coal Handling Costs

Rising costs of handling coal and other bulk materials are causing many companies to give up the idea of hand handling. And they are effecting a bigger saving than they thought possible by the installing of mechanical handling equipment. A Brownhoist locomotive crane should effect just as big a saving in your business as it has in the case of all these other companies.

The Brownhoist locomotive crane is a wonderfully useful machine wherever there is bulk material to handle. But it is not a one purpose machine that lies idle when your bucket work is finished. The Brownhoist's flexibility and all around usefulness make certain the fact that it will always be wanted for many jobs around the plant and yard.

If you are interested in handling material and would like to see some of the many jobs a Brownhoist will handle, and handle right, just write for catalog K. This is a complete book on locomotive crane work and will be sent you on request.

BROWNHOIST

Products Include:

Locomotive Cranes
Grab Buckets
Dragline Buckets
Electric Hoists
Tramrails and Trolleys
Overhead Tr. Cranes
Pillar and Jib Cranes
Heavy Dock Machinery
Suspended Concrete Bins

Write for Catalogs

The Brown Hoisting Machinery Company

40 Years in Crane Business

Cleveland, Ohio, U. S. A.

Engineers and Manufacturers of Heavy Dock Machinery
Bridge Cranes, etc., as well as smaller Cranes and Hoists

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OSGOOD

120

Digging Limestone for Cement

Here's an OSGOOD 120, 6-Yd. Steam Shovel that has made good in a big way. It successfully withstands the most severe conditions which exist in quarries, ore and copper mines, etc., and excavates difficult material without blasting.

Improved design makes this large shovel remarkably easy to handle and operate.

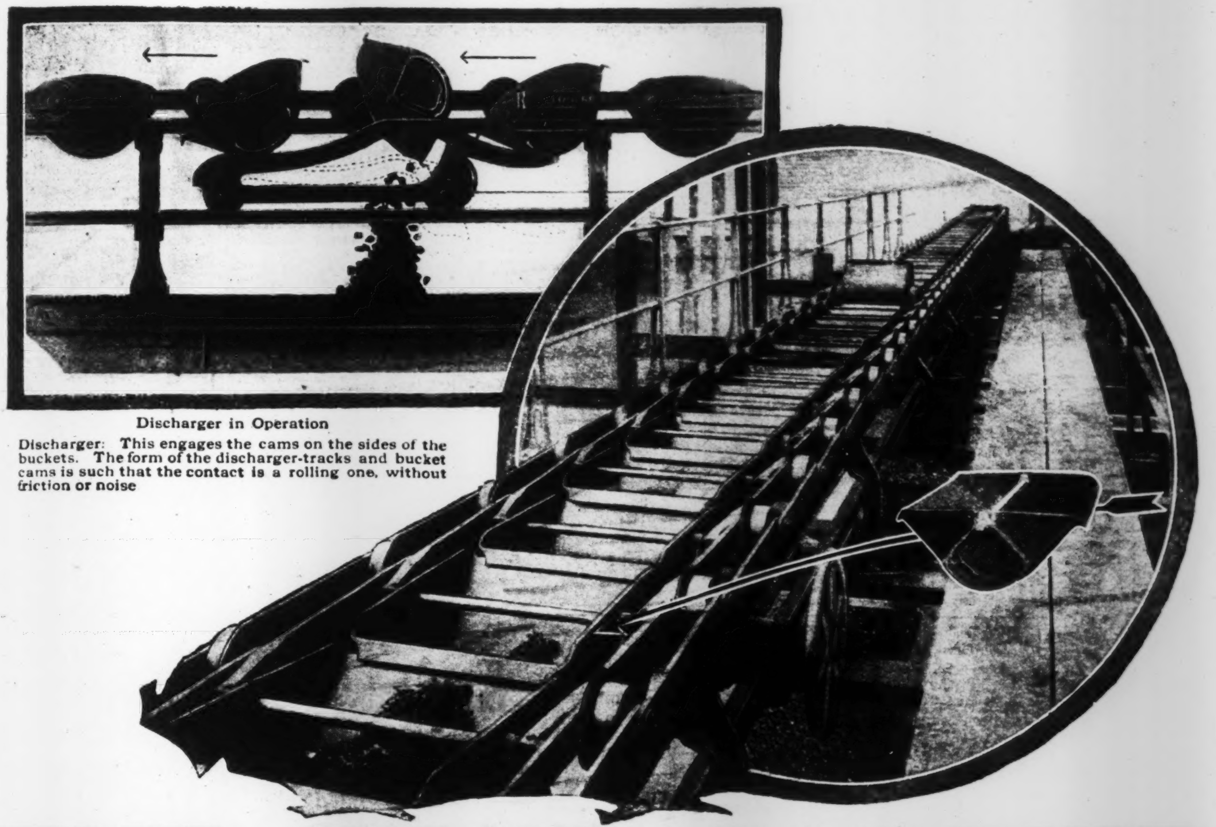
You should investigate the OSGOOD 120 if interested in a big, husky shovel that embodies all the latest features of approved shovel construction.

Write today for our General Catalog A-1.

Revolving and Railroad types 3/4 to 6 cu. yds.

The Osgood Company
Marion, Ohio

②
OSGOOD 120



Discharger in Operation

Discharger: This engages the cams on the sides of the buckets. The form of the discharger-tracks and bucket cams is such that the contact is a rolling one, without friction or noise

THE PECK CARRIER

Is the recognized standard machine for handling coal and ashes in the modern boiler plant, for cement clinker, stone, etc.

FOLLOWING its record of service in Power House work, the Peck Carrier is even supplanting the older combinations of belt or screw conveyors and elevators for the more important duties in cement mills. Constructed as it is, with relatively few wearing parts and these of the best design to resist wear, the cost of maintenance and power is far less than with the types of conveyors replaced; but of even greater importance is its reliability and freedom from delays, which are always serious in a continuous process like the manufacture of cement. In this feature of reliability, the Peck Carrier is unrivaled. It is extensively used and is in increasing demand for handling rock, and hot and cold clinker, besides coal and ashes in power house.

We believe it will be but a short time before the use of this Carrier for all but very short conveyors—and in all cases where material has to be both conveyed and elevated—will be universal.

Write for Catalog No. 220

LINK-BELT COMPANY 256

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We Also Make

- ☐ Elevators and Conveyors
- ☐ Link-Belt and Sprockets
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- ☐ Truck and Tractor Chains
- ☐ Electric Hoists
- ☐ Locomotive Cranes
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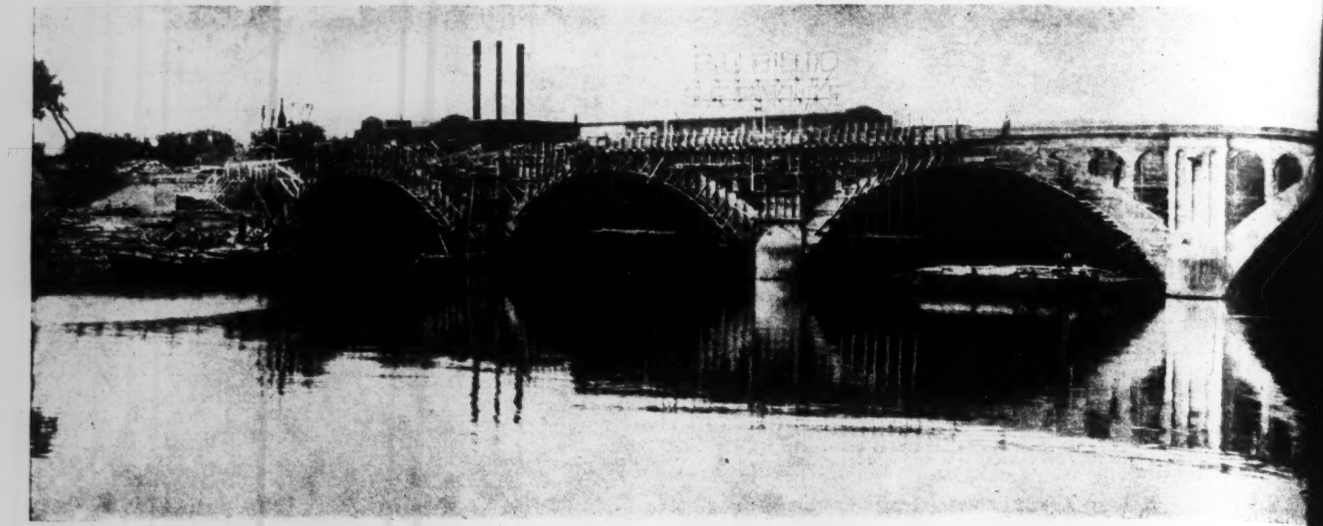
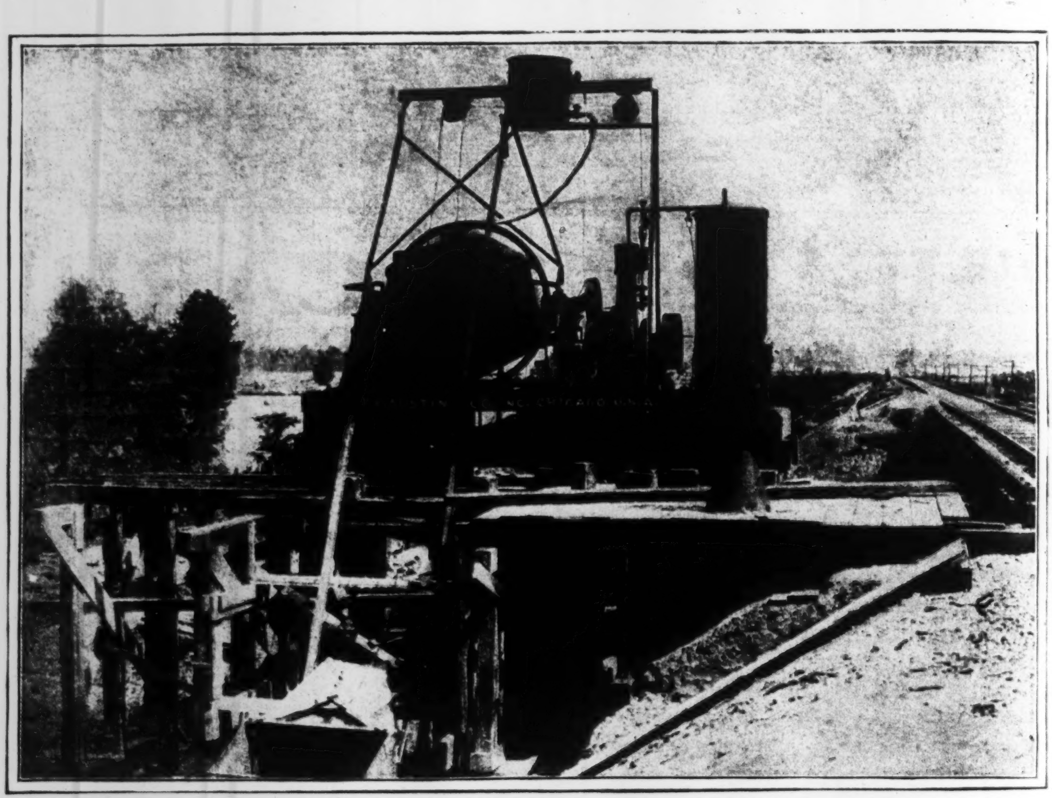
- ☐ Coal and Ashes Systems
- ☐ Coal Pockets

Write for Catalogs
Place X in Square

LINK-BELT
Elevators and Conveyors



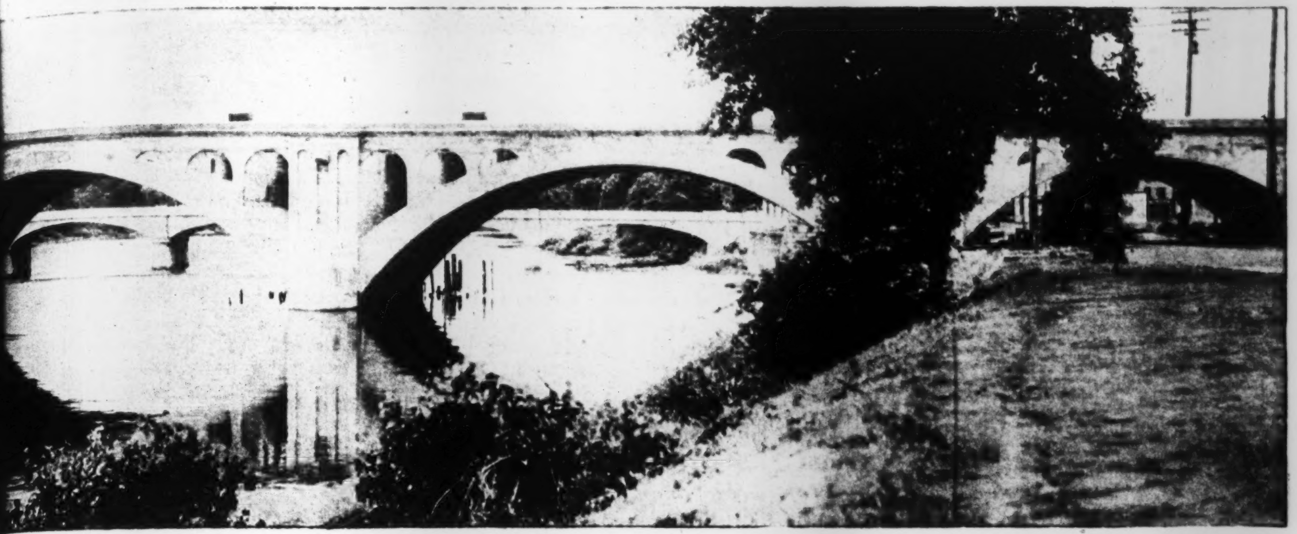
Illinois Central Ry. Bridge at Kankakee, Ill.



The above picture shows the possibilities in bridge work of bringing material in barges and elevating it to the best point of distribution.

AUSTIN
MOVES THE EARTH
MIXES THE CONCRETE
TRADE MARK

THE AUSTIN LINE



Built by the Gould Construction Co.

When You See A Big Job Look for

MACHINERY

AUSTIN

"MOVES THE EARTH-MIXES THE CONCRETE"

CUBE MIXERS

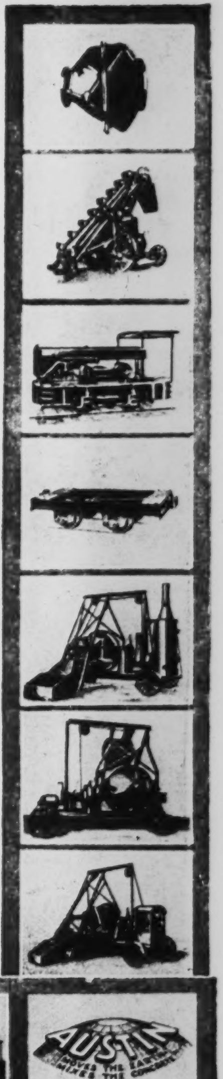
Seven cubes are owned by the Gould Construction Co. of Davenport, Iowa. Three of these have been in almost continuous use since 1907 on railroad construction work. The body design of the Austin Cube Mixer is such that every particle of concrete receives a full batch pressure kneading action with every turn of the cube. No other mixer gets this kneading action.

The red lead test is quick and thorough on an Austin Cube Mixer owing to this unusual kneading action.

AUSTIN MACHINERY CORPORATION

(F. C. Austin Consolidation)

Chicago Office: Railway Exchange Bldg. **New York Office: 30 Church St.**



AUSTIN
"MOVES THE EARTH-MIXES THE CONCRETE"
TRADE MARK

THE AUSTIN LINE

TELSMITH

THE ROAD BUILDER'S ROCK CRUSHER

Of course, the Telsmith Mounted Breaker costs more than a jaw crusher. It is built on most substantial lines and designed for economy of production rather than for a low selling price. It includes an all-steel pivoted elevator and a big steel charging platform. Telsmith's big feed areas cut down sledging and block-holing. Liberal use of metal reduces maintenance cost. But Telsmith's most striking characteristic is BIG CAPACITY. The No. 5 machine crushes 25-35 cu. yds. per hour of 1¾-in.-2½-in. product. It doubles and trebles the output of any other portable crusher on the market; and yet the feed level is only 6 ft. 3 in. It weighs a shade under 15 tons; takes only 30 H. P. It's a brute for strength, yet not too heavy for portability—the ideal equipment for the big road job, where large capacity and portability are both essential.

But still more important, in the long run, is Telsmith's SUPERIOR PRODUCT.

The Telsmith Mounted Breaker has a conical head gyrating in a cylindrical bowl. Its circular bottom makes *cubical rock*. Thin, flat slabs are caught by the big crushing cone. The long, horizontal pinch cubes them—shapes them into strong, sound, cubical rock. Compare the Telsmith discharge circle with the long, straight opening of a jaw crusher; and you will understand why Telsmith makes a BETTER ROAD METAL.

Glad to send you Bulletin No. 1-M-1 describing the Telsmith Mounted Breaker

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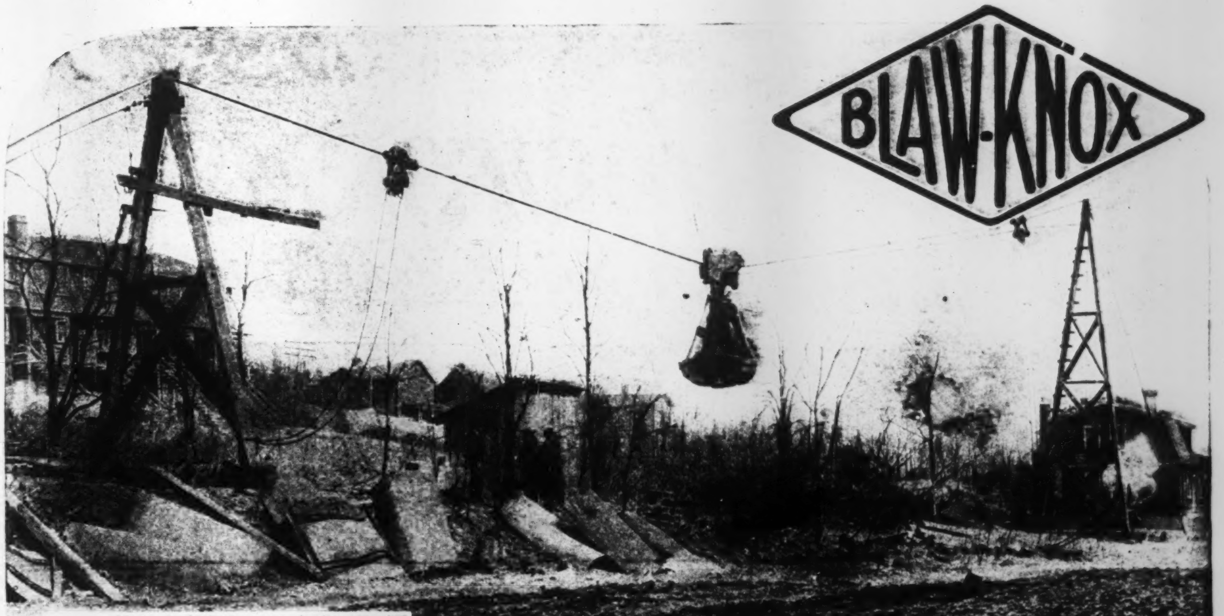
BLAW-KNOX



Clamshell Cableways
Single Rope-Automatic

Rehandling crushed stone, sand, coal and other loose bulk materials from piles to cars, or vice versa, can be accomplished simply and economically by a cableway installation such as illustrated above.

A Blaw Single Line Bucket installed on this simple A-frame arrangement, provided with a Blaw Automatic Single Rope Cableway Carriage, can be operated by one man at a single-drum hoisting engine.

Save labor and time by eliminating hand loaded skip buckets for transporting your loose bulk materials—you don't have to buy new hoisting equipment when you make a Blaw Automatic Cableway installation; your present single drum engine will operate it.

A Blaw Cableway installation will replace 75% of your working force—the saving accomplished thereby will offset the cost of the installation in a short time.

Our engineers will assist you in selecting the proper equipment—write for a detailed account of this apparatus.

Note—These products are built and trade-marked by Blaw-Knox Company: Steel Forms for Concrete Construction—Clamshell Buckets—Fabricated Steel Specialties—Water-Cooled Appliances for High-Temperature Furnaces—Pressed Riveted and Welded Plate Work—Standardized Sectional Steel Buildings

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COMPANY

PITTSBURGH, PA.
601 Farmers Bank Bldg.

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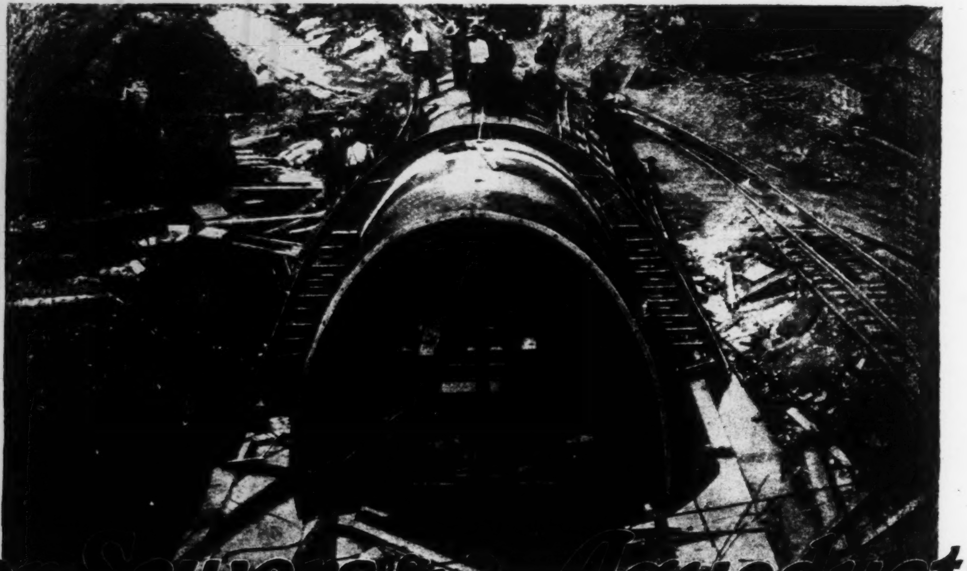
BLAWFORMS

Travelling (Made of Steel) Collapsible



For Sewers and Aqueducts

Eliminate surplus labor and speed up construction work on your next sewer job by leasing a set of Blaw Steel Sewer Forms.

Compare the advantages of a set of standardized, collapsible steel forms—which can be quickly erected and dismantled by unskilled labor—with the obsolete and expensive method of wood form construction.

Consider the scarcity of lumber; its high cost; the expensive expert labor required to build and knock down the forms and the large pile of almost useless lumber on your hands when the job is finished—and compare the appearances of a wood form and a steel form built sewer.

Blaw Sewer Forms are labor savers, time savers and money savers—they will build real sewers.

Blaw Sewer Forms of standard sizes and shapes are carried in stock—and leased to you. Sewers of especially large size or odd design require special forms, which we will design and build to suit your needs.

Submit your proposition to us for an estimate—write us.

Note—These products are built and trade-marked by Blaw-Knox Company: Steel Forms for Concrete Construction—Clamshell Buckets—Fabricated Steel Specialties—Water-Cooled Appliances for High-Temperature Furnaces—Pressed Riveted and Welded Plate Work—Standardized Sectional Steel Buildings

BLAW-KNOX COMPANY

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Building Curbs Integral with the Pavement

Save at least 50% of the cost of constructing curbs or combined curbs and gutters by building your curb integral with the pavement—curb and pavement are poured simultaneously.

A set of Blaw Universal Forms—the **same set which** you use for building all kinds of streets, curbs, gutters or sidewalks—adapt themselves to this type of construction by simply adding Blaw Steel Face Forms to your standard equipment. Blaw Steel Face Forms are indispensable in this type of construction, particularly when the specifications require that the face of the curb be curved.

They obviate the use of special, cumbersome, extremely expensive and impracticable wooden forms.

Blaw Universal Forms for road and street construction of all kinds will save you money by conserving time, labor and form material—the increased profits on your first job offset their cost.

Catalog No. 19 describes Blaw Universal Forms in detail—write for it.

Note—The following products are built and trade-marked by Blaw-Knox Company; Steel Forms for Concrete Construction—Clamshell Buckets—Fabricated Steel Specialties—Water Cooled Appliances for High Temperature Furnaces—Pressed, Riveted and Welded Plate Work—Standardized Sectional Steel Buildings

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Moving Day when the Big Job is started

Easily transported and quickly erected by unskilled labor—Blaw-Knox Prudential Steel Buildings eliminate the worries of housing your men, machinery and materials.

Do away with expensive wooden buildings and the high-priced labor required to erect them by providing, as an addition to your contracting equipment, portable steel buildings of a standardized design which give you universal service as bunkhouses, mess halls, field offices, storage and warehousing facilities—buildings which will serve *all* of your requirements.

Blaw-Knox Prudential Steel Buildings are *cheaper* than wooden buildings—and there is no end to their usefulness.

Furnished in widths from 8 to 50 feet, and in any length, we are prepared to ship from stock immediately a building or buildings of any size desired.

Write, wire or phone our nearest office.

Note—These products are built and trade-marked by Blaw-Knox Company: Steel Forms for Concrete Construction—Clamshell Buckets—Fabricated Steel Specialties—Water-Cooled Appliances for High-Temperature Furnaces—Pressed Riveted and Welded Plate Work—Standardized Sectional Steel Buildings

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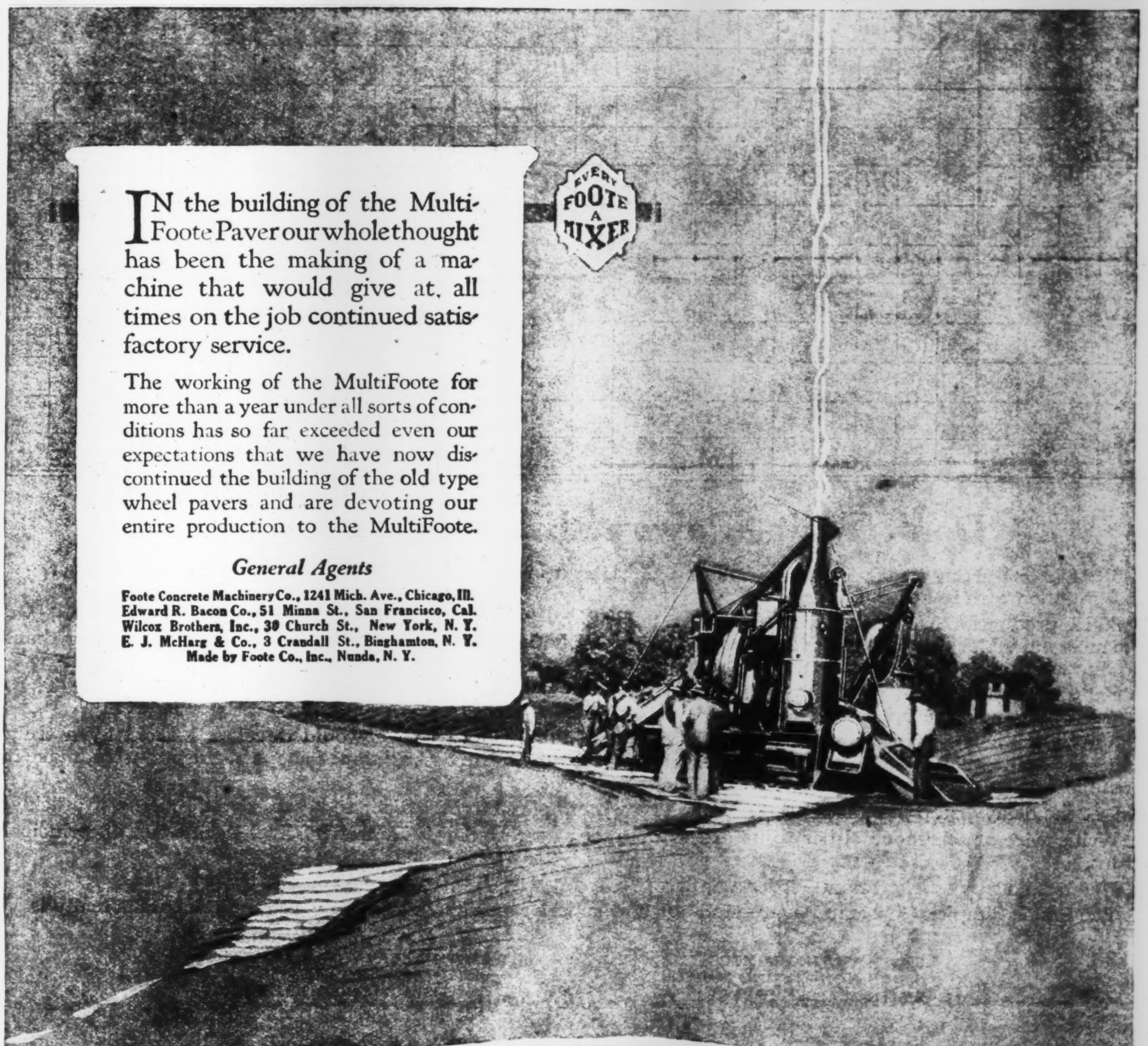
ROAD MULTI FOOTE PAVER
TRADE MARK REGISTERED



IN the building of the MultiFoote Paver our whole thought has been the making of a machine that would give at all times on the job continued satisfactory service.

The working of the MultiFoote for more than a year under all sorts of conditions has so far exceeded even our expectations that we have now discontinued the building of the old type wheel pavers and are devoting our entire production to the MultiFoote.

General Agents

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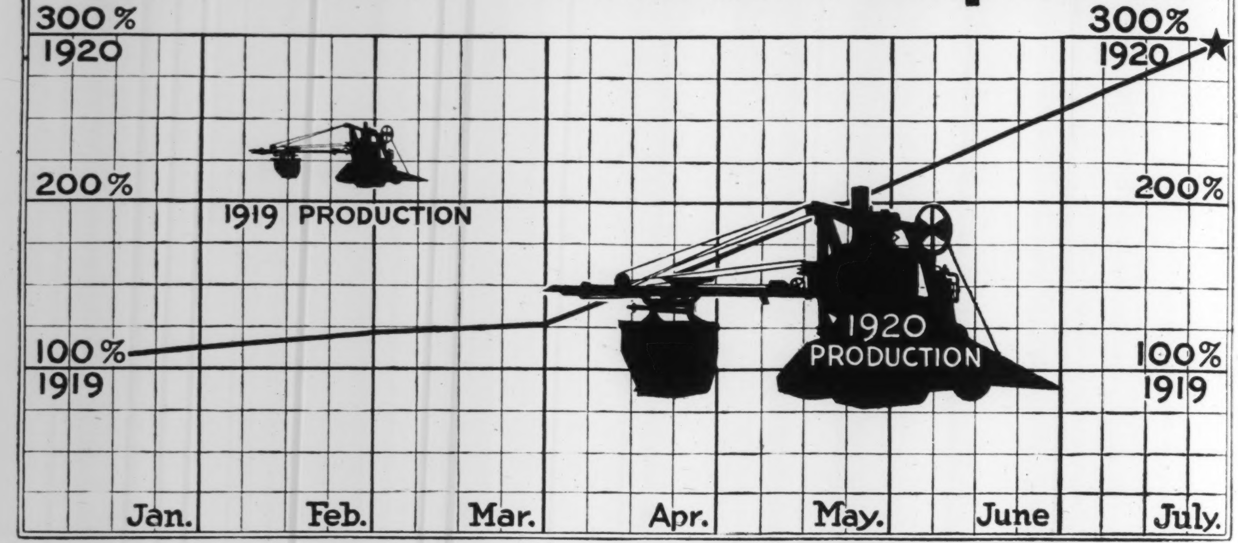
Edward R. Bacon Co., 51 Minna St., San Francisco, Cal.
Wilcox Brothers, Inc., 30 Church St., New York, N. Y.
E. J. McHarg & Co., 3 Crandall St., Binghamton, N. Y.
Made by Foote Co., Inc., Nunda, N. Y.

FULL LENGTH MULTIFOOTE TREAD

At Last—Production 300%

Smith Pavers—Immediate Shipments



Don't Wait—Pave with a Smith—You Win!

SPEED in starting and finishing that paving job is essential—right now! If you are still *waiting* for a paver, get in touch with us at once. Don't wait! Start work!

Smith production has in six months mounted to 300% over the 1919 output. Demand for the Smith Simplex—the most valuable paver in the world—has urged our production to *a paver a day*. That is equal to, or better than, production attained by any one manufacturer specializing on pavers *alone*.

Yet the production of paving mixers constitutes less than one-quarter of the total production of the T. L. Smith Company's factories.

Foresightedness and a practical understanding of requirements as they would develop, backed by a truly efficient organization following a definite production schedule in the best equipped shops in this industry, make it possible for you to now get speedy deliveries—*a paver a day!*

Cut the delay—stop procrastinating. *Order* a Smith Simplex Paving Mixer today and you'll *receive* it quickly!

Write, wire or telephone either to us direct, or to the nearest Smith Representative—located in 48 principal cities.

If you need a paver right now—order a Smith.

The Smith Simplex Gasolene Paver—find out how superior and how suited to *your* requirements it really is.

SMITH TILTING MIXERS
SMITH NON-TILTING MIXERS
SMITH SIMPLEX PAVERS
SMITH EXCAVATOR & LOADER
SMITH PUMPING OUTFITS
CONSTRUCTION EQUIPMENT

THE T. L. SMITH COMPANY

426 Old Colony Bldg., Chicago, Illinois

SMITH PAVER

Eleven Handbooks to Help YOU

EXAMINE ANY OF THEM *FREE*

HANDBOOK OF HYDRAULICS
HIGHWAY ENGINEERS' HANDBOOK
AMERICAN MACHINISTS' HANDBOOK
AMERICAN ELECTRICIANS' HANDBOOK

1 *Hool & Johnson's*
CONCRETE ENGINEERS' HANDBOOK. 885 *pages*, 6 x 9, *flexible*, $6.00 *net, postpaid.* A concise encyclopedia of modern concrete construction — a working manual for the concrete engineer. It is the one book you will turn to confidently when you want authoritative information on concrete.

2 *Thomas & Nichols'*
REINFORCED CONCRETE DESIGN TABLES. 208 *pages, pocket size, flexible.* $3.00 *net, postpaid.* Design tables fully worked out. It saves time and trouble for the reinforced concrete designer.

3 *Gillette's*
HANDBOOK OF ROCK EXCAVATION. METHODS AND COST. 825 *pages*, 5 x 7½, *fully illustrated, flexible binding.* $6.00 *net, postpaid.* A manual of the best modern practice in drilling and handling rock of all kinds under all conditions, illustrating latest machines and methods, with costs of actual work done

4 *Marks'*
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RAILROAD CURVES AND EARTHWORK FIELD AND OFFICE TABLES. 516 *pages, pocket size, flexible.* $4.00 *net, postpaid.* The standard railway field book of today.

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STRUCTURAL ENGINEERS' HANDBOOK. 896 *pages*, 6 x 9, *flexible*, $6.00 *net, postpaid.* On the score of practical usefulness, there is nothing that the man engaged in structural work can possess that will compare in value with this book.

7 *King's*
HANDBOOK OF HYDRAULICS. 420 *pages, pocket size, flexible.* $3.50 *net, postpaid.* The only modern handbook devoted exclusively to hydraulics. It covers every phase of common practice and many special problems and presents much new information never before published.

8 *Flinn, Weston and Bogert's*
WATER-WORKS HANDBOOK. 824 *pages*, 6 x 9, *flexible.* $6.00 *net, postpaid.* The material ranges from the sources of water supply, through the collection, transportation, delivery and distribution of water to the character and treatment of water.

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HANDBOOK OF MATHEMATICS FOR ENGINEERS. 191 *pages, pocket size, flexible.* $2.00 *net, postpaid.* A reprint of sections I and II of Marks.

11 *Harger and Bonney'*
HIGHWAY ENGINEERS' HANDBOOK. 986 *pages*, 4½ x 7, *flexible.* $5.00 *net, postpaid.* A new third edition of the highway engineer's most practical field book. This new edition covers all types of road construction.

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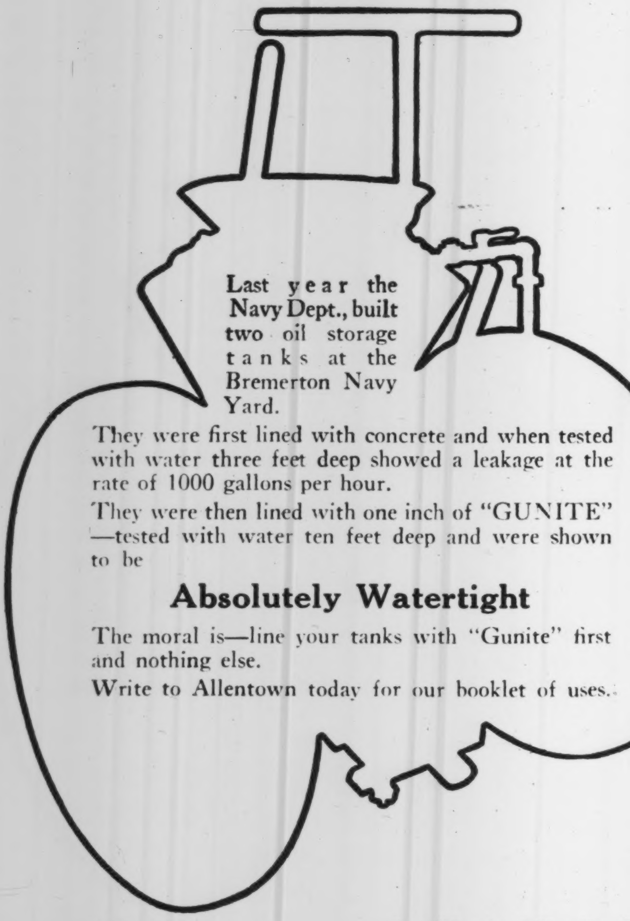
N.R. 6-24-20

CEMENT-GUN
TRADE MARK

Here's Another Gunite Record



Last year the Navy Dept., built two oil storage tanks at the Bremerton Navy Yard.

They were first lined with concrete and when tested with water three feet deep showed a leakage at the rate of 1000 gallons per hour.

They were then lined with one inch of "GUNITE"—tested with water ten feet deep and were shown to be

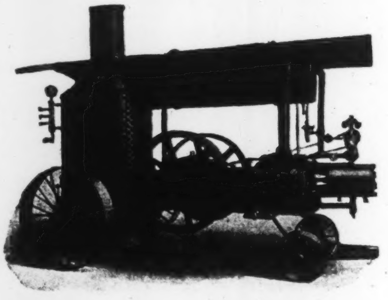
Absolutely Watertight

The moral is—line your tanks with "Gunite" first and nothing else.

Write to Allentown today for our booklet of uses.

Traylor Portable steam or electrically driven air compressors for mine contractor.

Dewey combined air dryer and water heaters deliver DRY AIR to your "gun" or air tools.



Our "Book of Uses" will interest you. Write TODAY for your copy.

Cement-Gun Company, Inc.

Allentown, Penna.

30 Church St., New York City; 904 Chamber of Commerce Bldg., Chicago, Ill.; 204 R. A. Long Bldg., Kansas City; 211 Fulton Bldg., Pittsburgh, Pa.; Citizens National Bank Bldg., Los Angeles, Calif.; 612 Mohawk Block, Spokane, Wash.; 812 Virginia Railway and Power Bldg., Richmond, Va.; General Supply Co., Ltd., Winnipeg, Manitoba.

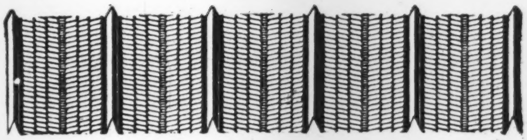
Agencies in all principal foreign countries

The Cement-Gun is not a restricted article. It may be purchased outright from us and used by anyone.

3/4 Inch 3/8 Inch RIBPLEX

Here are two Berloy products which possess unequalled advantages for certain specific construction uses. Both are ribbed Metal Lath, but each has a field of its own.

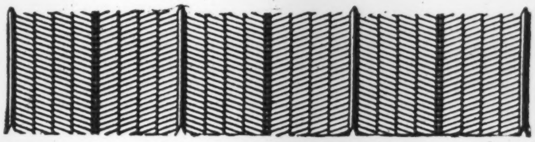
Three-fourths-Inch Ribplex



Ribs are 3/4 in. high spaced 4.8 inches on centers. Plates have a covering width of 24 inches. Stock lengths 4, 5, 6, 7, 8, 9, 10, 11 and 12 ft. 3/4-in. Ribplex is made of Open Hearth Steel in 24, 26 and 28 gauge, and painted black, also of Toncan Metal in 24 and 26 gauge, painted red.

This product forms centering and reinforcement for light, strong, fire-resistive and economical concrete walls, partitions, light service floors and roofs that need be no more than two inches thick. Our new Bulletin 24K gives complete information about the use of Three-fourths-Inch Ribplex. Write for it.

Three-eighths-Inch Ribplex



Ribs are 3/8 in. high and spaced 8 inches on centers.

Each sheet is 8 feet long and has a covering width of 24 inches.

3/8-inch Ribplex is made of Open Hearth Steel in 24, 26 and 28 gauge and painted black, or of Toncan Metal in 24 and 26 gauge, painted red.

This is the ideal metal lath for all straightaway lath work—walls, ceilings, partitions and overcoating.

The ribs give strength and stiffness and the stiff on edge mesh adds to the firmness of the sheet.

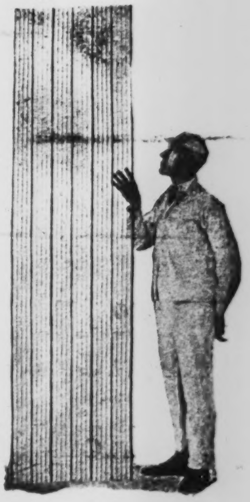
With this lath, supports may be spaced up to 36 inches—a substantial economy.

Three-eighths-Inch Ribplex goes into place very rapidly and the ribs nest together at margins to form a firm, even plastering surface without bulges or other irregularities.

Three-eighths-Inch Ribplex offers all of the Metal Lath advantages of fire-resistance, crack prevention and permanence, plus many other advantages, some of which are mentioned above.

The cost of Three-eighths-Inch Ribplex compares favorably with that of Expanded Metal Lath. May we supply further information?

Other Berloy building products are Metal Lumber, Floor Cores, Expanded Metal Lath. Write nearest Berger office for information on any product.



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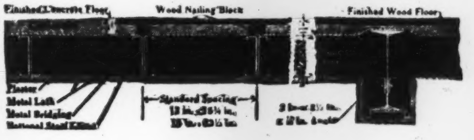
Finished Concrete Floor
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Finished Wood Floor
Plaster
Metal Lath
Metal Bridging
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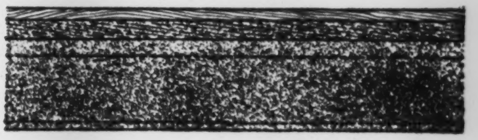

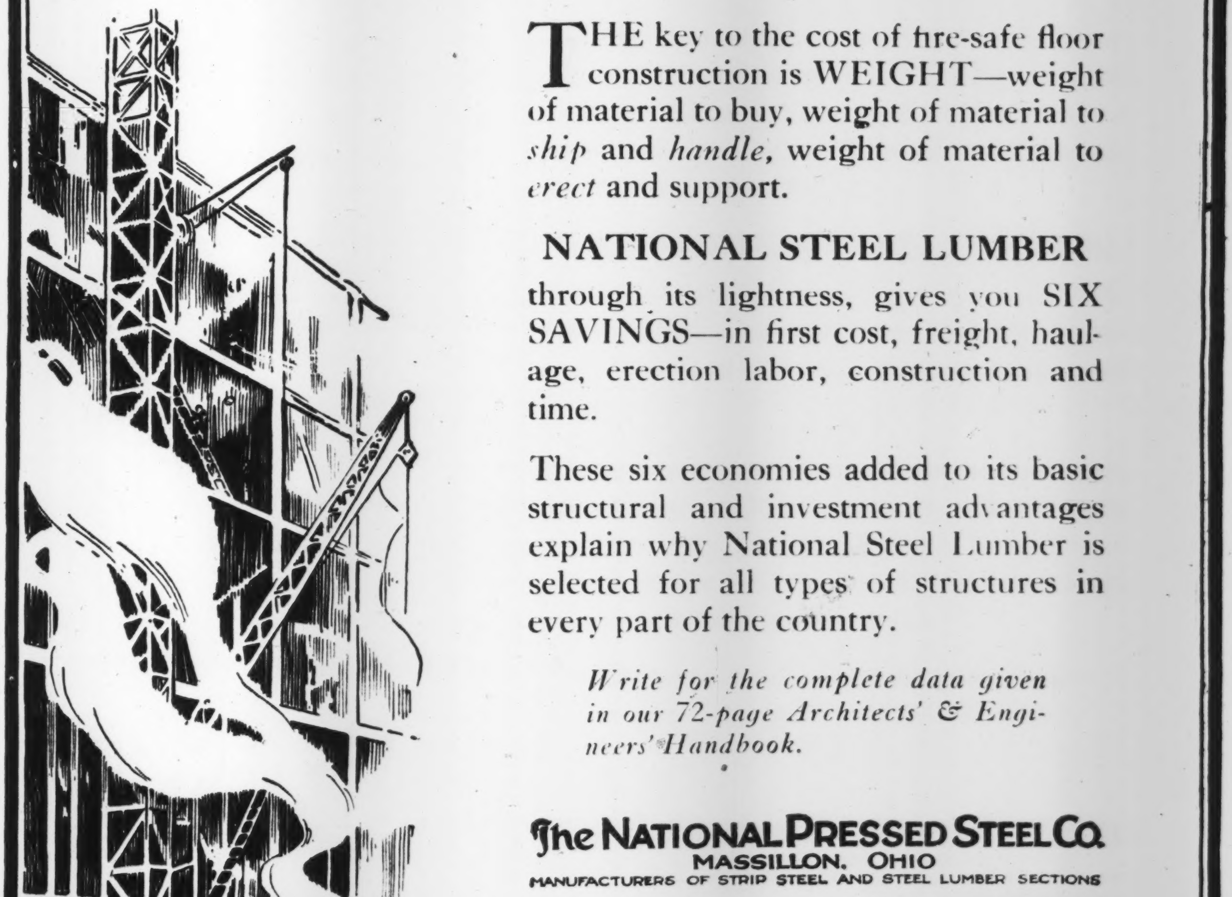

THE key to the cost of fire-safe floor construction is WEIGHT—weight of material to buy, weight of material to *ship* and *handle,* weight of material to *erect* and support.

NATIONAL STEEL LUMBER

through its lightness, gives you SIX SAVINGS—in first cost, freight, haulage, erection labor, construction and time.

These six economies added to its basic structural and investment advantages explain why National Steel Lumber is selected for all types of structures in every part of the country.

Write for the complete data given in our 72-page Architects' & Engineers' Handbook.

The NATIONAL PRESSED STEEL Co.
MASSILLON, OHIO
MANUFACTURERS OF STRIP STEEL AND STEEL LUMBER SECTIONS

Structural steel fabricators render complete local service. Get comparative bids.

More Welded Joints

FOUR weeks ago we showed one of the welded muntin joints of Pond Continuous Sash. Every joint of that sash is solidly welded into permanent rigidity.

Here we show a corner joint of Lupton Counterbalanced Sash, before and after grinding. It, too, is welded into a continuous mass of metal. Not the minutest crevice remains to harbor corrosion.

Lupton Counterbalanced Sash is in a class by itself among sliding sash. Massive in design and handsome in appearance, with large lights unbroken by horizontal muntins, it gives a striking dignity to buildings containing it. Air leakage is minimized by closely-fitting jambs and mullions; and this close fit is preserved by the permanent rigidity of the welded assembly. High ventilating efficiency is secured by the counterbalanced principle, since top and bottom openings are always equal.

Lupton Counterbalanced Sash is used both for factories and for offices. Shall we send Catalogue 10-LCB?

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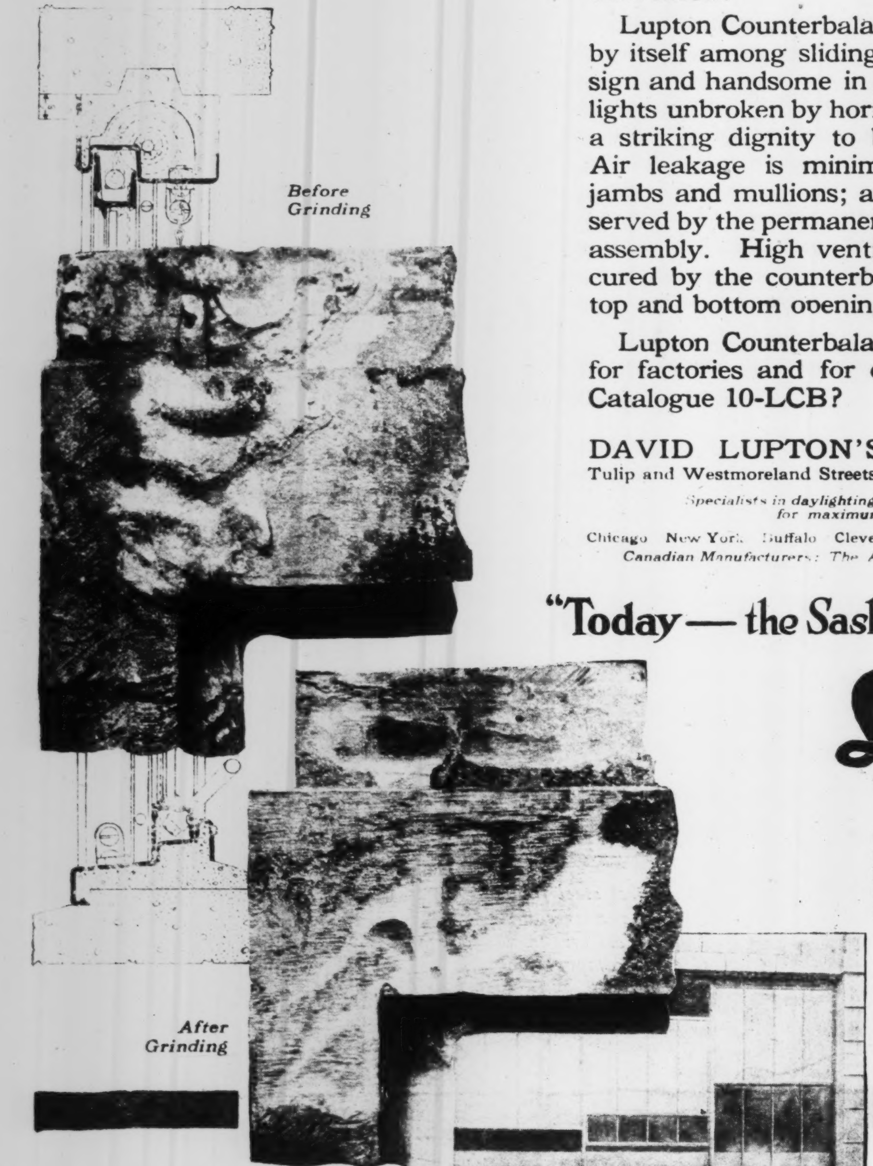

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Greater Production Facilities *At Once*

The demand for increased production in many industries can be met only by enlarging production space. In order to be profitable, such space must often be provided immediately.

How can this be done without the delays incident to building? Buildings, like commodities, are in great demand—twice as much permanent construction being called for this year as there are materials, labor and transportation to build.

Erect Hydraulic Pressed Steel Buildings. They are shipped promptly—quickly put up—constructed of standardized units—strong and durable.

Place them wherever needed in order to obtain maximum use from them *now.* Move them about later if conditions warrant. For temporary or permanent use, Hydraulic Steel Buildings fill very definite needs.

Write our nearest office about your building problems.

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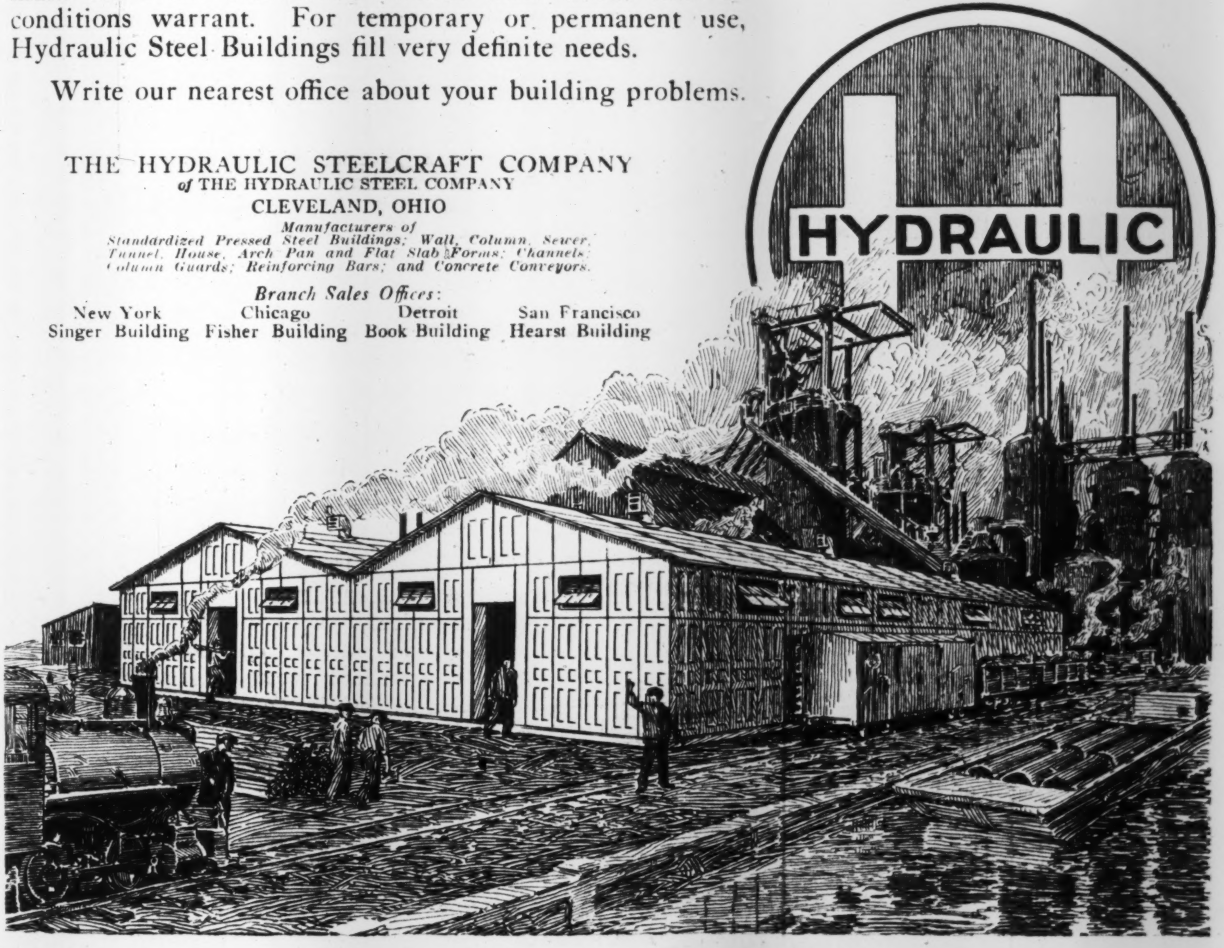

Hydraulic Steel Buildings

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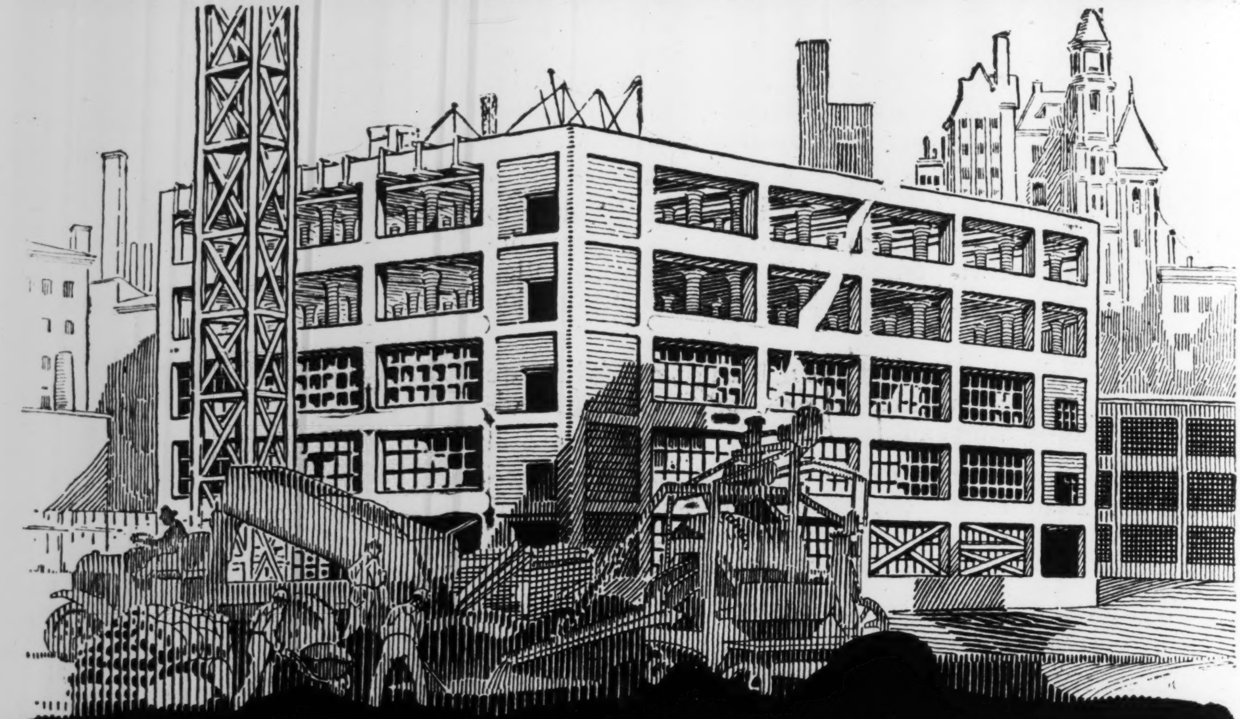

Self-Sentering

SELF-SENTERING is a ribbed expanded metal for concrete reinforcing and miscellaneous fireproofing. It is, in itself, a *combined form and reinforcement* for concrete slabs, a *one-piece steel lath and stud* for walls and partitions. It is easily adapted for use in roofs, floors and ceilings.

Self-Sentering, in roof construction overcomes the disadvantages found in other forms of concrete roof construction. Because no forms are required, it lowers the cost and makes possible lighter weight construction; the large sheets permit rapid erection with minimum labor cost. Self-Sentering roof slabs need be only two inches thick—thus lowering dead load weight.

Self-Sentering floor construction is very similar to roof work, except that, of course, it must be heavier to conform to loads carried. Self-Sentering has eliminated the expensive part of concrete floor construction—*form work*—without lessening the strength of the floor.

In fireproof ceiling work where suspended ceilings are required, or where beams or other supports are too far apart to permit the use of metal lath without cross furring, Self-Sentering acts as both lath and furring, the heavy ribs taking the place of small channels or angles necessary with other forms of ceiling construction.

From our new "Fireproofing Handbook." Ask for it today.

The General Fireproofing Co., Youngstown, O.

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Courtesy of the Association of American Portland Cement Manufacturers.

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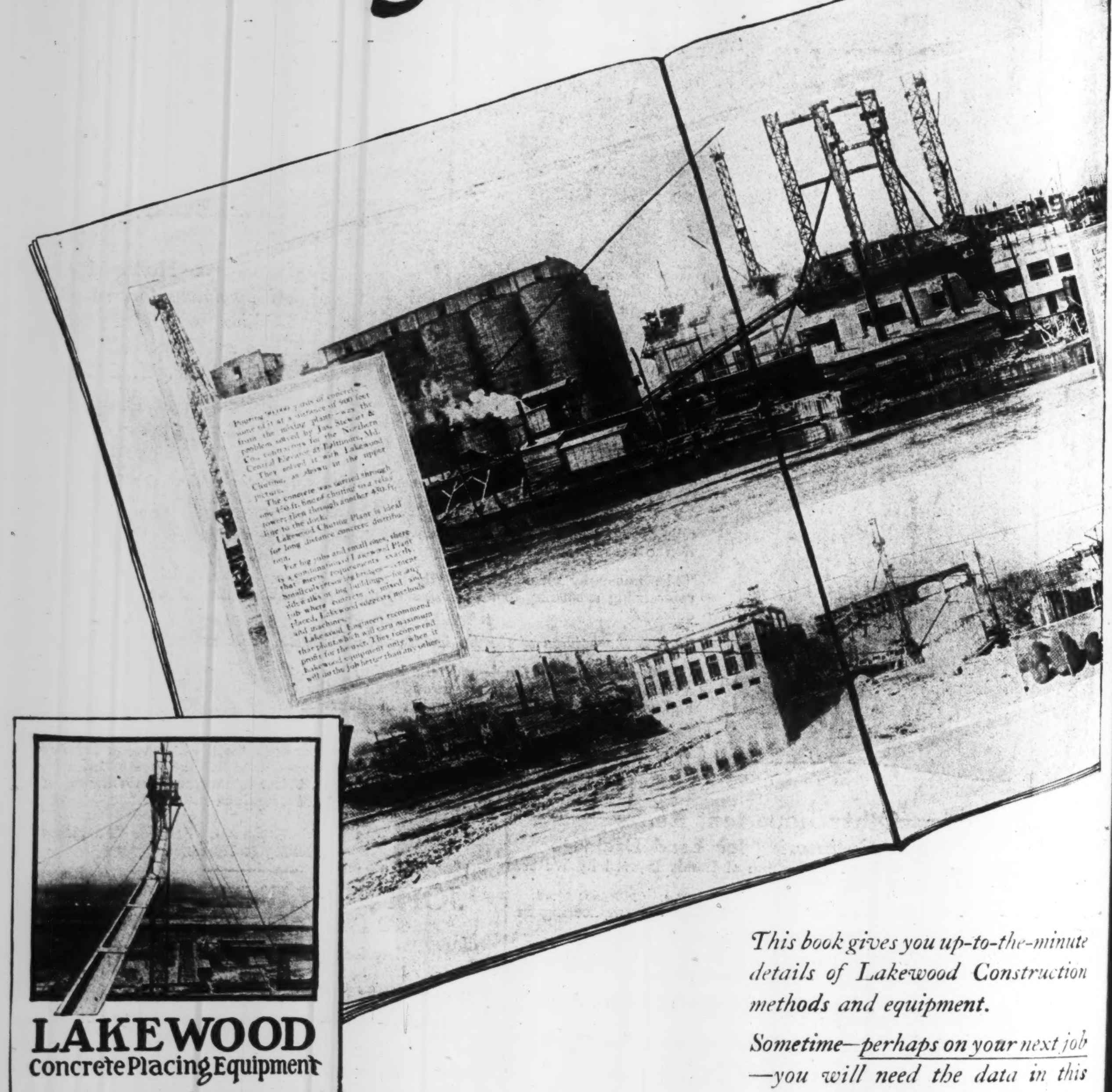
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LAKEWOOD
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Lakewood Road Plants
of Many of the Present

Lakewood Plants Reduce Contingencies

At the present time there are many factors making it difficult, if not impossible, for contractors to bid intelligently for road work. There are so many factors over which they have no control, that contractors are forced to bid high without any assurance that they are bidding safely. The Lakewood Way reduces many of the contingencies encountered on road construction.

Lakewood Plants Relieve Labor Shortage

The Lakewood Plant is operated with only a total of 40 to 45 men. This number of men with a LAKEWOOD Plant and favorable conditions, can complete 10 to 15 miles of 18 ft. road per year. The work for the crew is not hard. It is interesting, and it is possible to keep the men satisfied. Labor costs and labor troubles are reduced to the point that the shortage of common labor is not seriously felt.

Shortage of Railroad Cars Relieved

When the LAKEWOOD Plant is used efficiently, it has the effect of reducing car shortage. The unloading of railroad cars is made independent of any other operation in road building, and independent of weather conditions. As soon as the cars are received they may be unloaded. Demurrage charges are reduced—in many cases eliminated. The cars are released immediately for other service.

Lakewood Plants Relieve Cement Shortage

The cement manufacturing companies are having difficulty in procuring bags in which to ship cement. The LAKEWOOD answer, so far as road building is con-

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BUILT TO LAST

THE LAKEWOOD ENGINEERING COMPANY, CLEVELAND, U.S.A.

Makers of Lakewood Construction Plant

Lakewood
Road Construction Plant

LAKEWOOD BUILT TO LAST

Are The Best Solution

Problems of Contractors

cerned, is to use bulk cement shipped in gondola cars, with a tarpaulin covering, the unloading being done with a clamshell bucket. If all the bags which are now required for cement for road building purposes could be diverted to cement which is sold in smaller quantities through city and country dealers, the effect on the whole cement industry would be extremely beneficial, and much good would result to the whole construction industry.

Make Possible The Use of Large Aggregate

The present shortage of stone and pebbles can be partly overcome by using materials from local quarries, gravel pits, or other sources of supply. LAKEWOOD suggests, however, that if the maximum size of aggregate used in concrete were raised to 2½ or 3 inches, the output of these quarries would be materially increased. Less crushing, screening, etc., would be necessary. LAKEWOOD Plant can handle large aggregate just as efficiently as the small aggregate. The finishing machine will compact concrete with large aggregates and make an even stronger slab than is possible with finer materials.

Eliminates Wastage of Materials

The LAKEWOOD Way eliminates practically all waste of materials. When it is remembered that this waste often amounts to ten per cent of a coarse aggregate, it will be realized that a tremendous saving is possible. It is evident that the LAKEWOOD Way should be seriously considered by all engineers and contractors interested in highway construction at this time.

Lakewood Engineers will be glad to consult with you regarding your own particular problems, and to give you proof of the above facts.

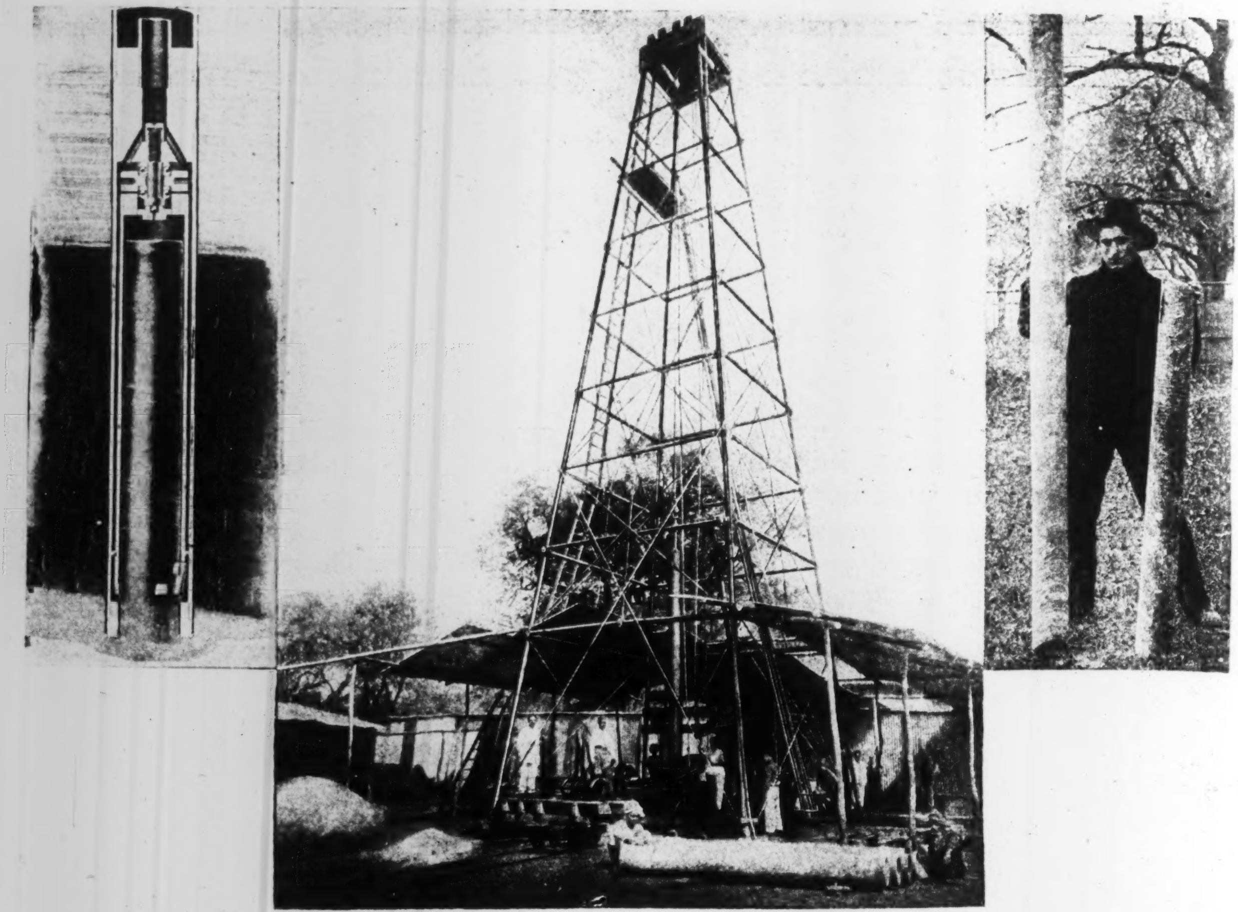
THE LAKEWOOD ENGINEERING COMPANY, CLEVELAND, U.S.A.

LAKEWOOD BUILT TO LAST

Makers of Lakewood Construction Plant

Lakewood

Road Construction Plant



CALYX CORE DRILLS

give the most accurate information possible to secure regarding mine property—a complete record of the texture, structure and composition of the overlying, underlying, and ore-bearing strata. This information is essential to determine the most efficient and economical methods of developing and operating.

The CALYX CORE DRILL penetrates any material from the softest clay to hardest rock.

It will give cores from $1\frac{1}{2}$ in. to $16\frac{1}{2}$ in. and will penetrate to a depth of 4000 ft.

It drills straight holes.

It uses "CALYXITE," a chilled steel shot, in place of diamonds, thus reducing initial cost and dispensing with the services of an expensive diamond setter.

Bulletin No. 9201, giving complete information, sent upon request.

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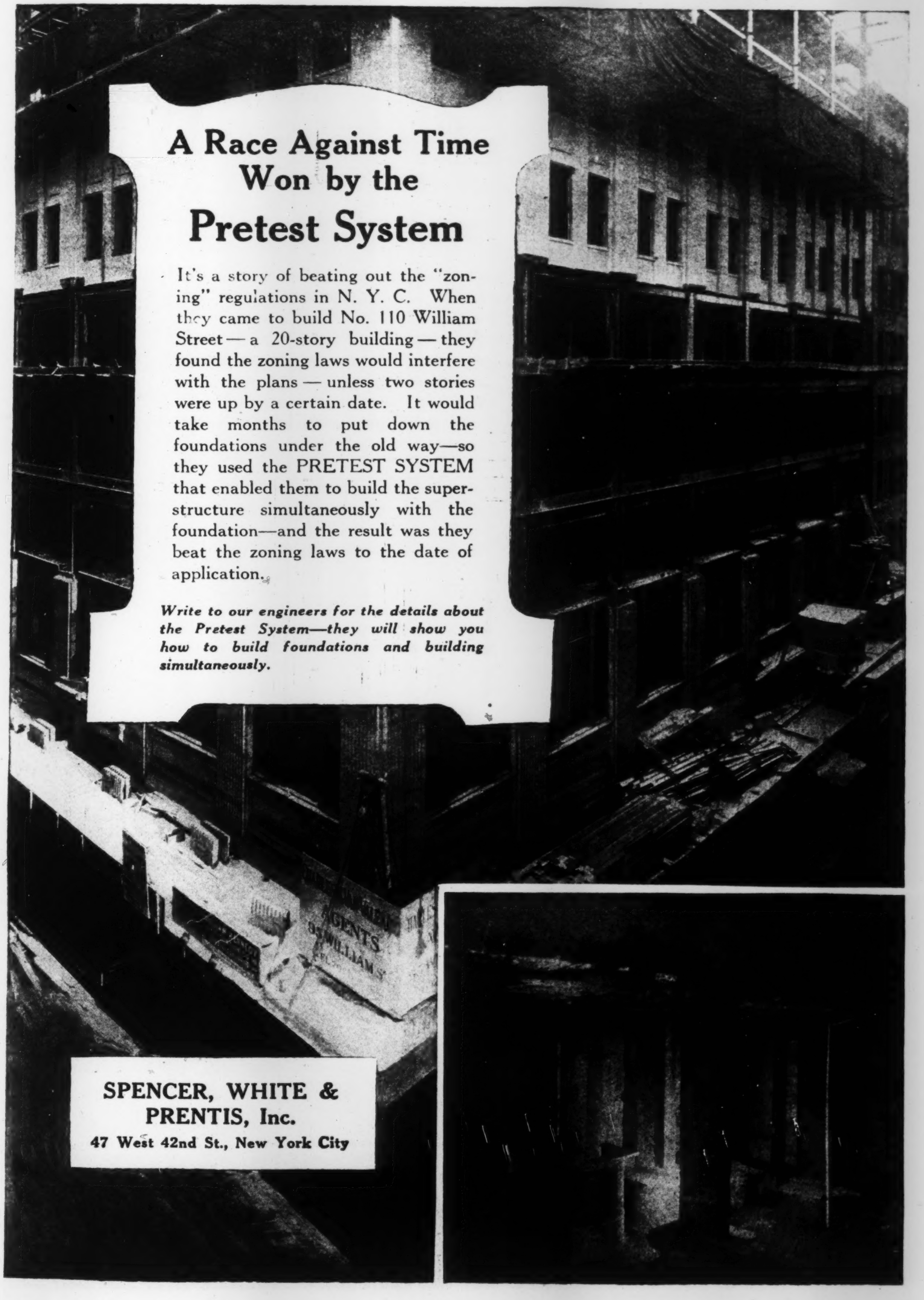


A Race Against Time Won by the

Pretest System

It's a story of beating out the "zoning" regulations in N. Y. C. When they came to build No. 110 William Street — a 20-story building — they found the zoning laws would interfere with the plans — unless two stories were up by a certain date. It would take months to put down the foundations under the old way—so they used the PRETEST SYSTEM that enabled them to build the superstructure simultaneously with the foundation—and the result was they beat the zoning laws to the date of application.

Write to our engineers for the details about the Pretest System—they will show you how to build foundations and building simultaneously.

SPENCER, WHITE &
PRENTIS, Inc.
47 West 42nd St., New York City

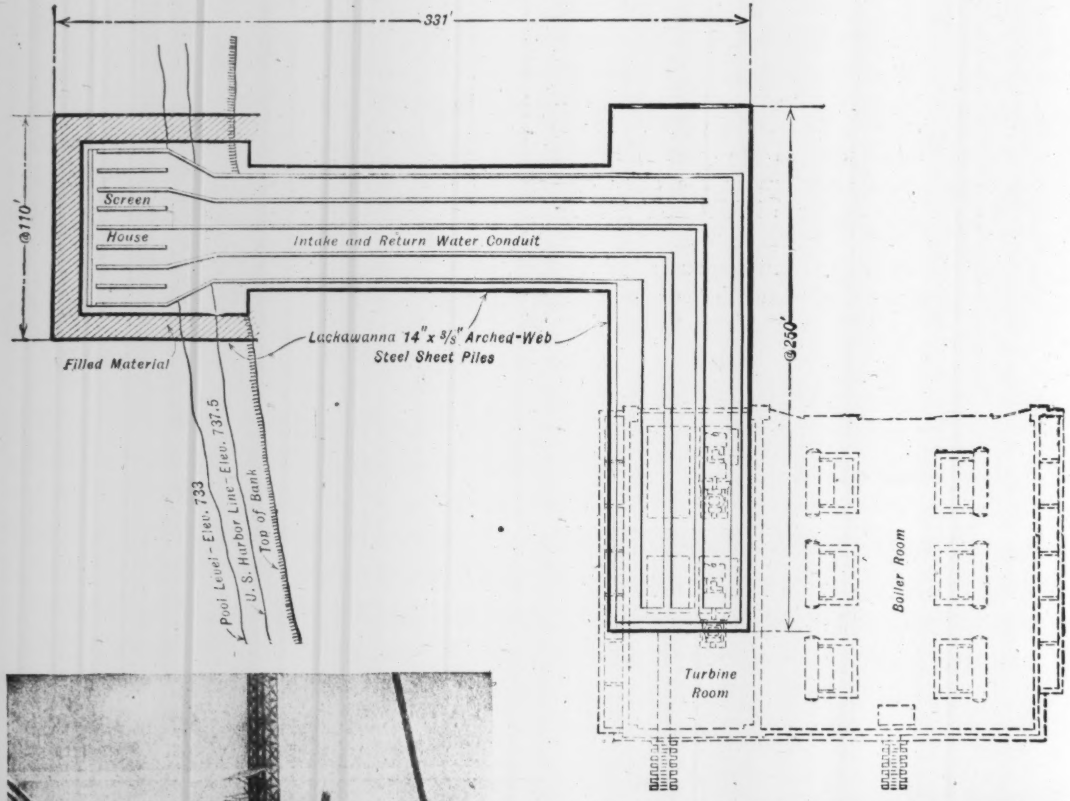
Lackawanna Steel Sheet Piling Cofferdams

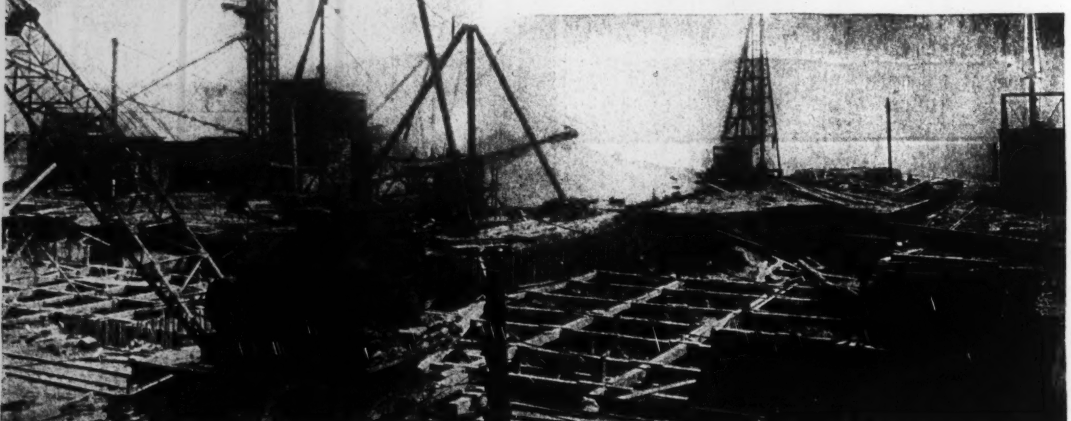
at the Springdale (Pa.) plant of the West Penn Power Co.

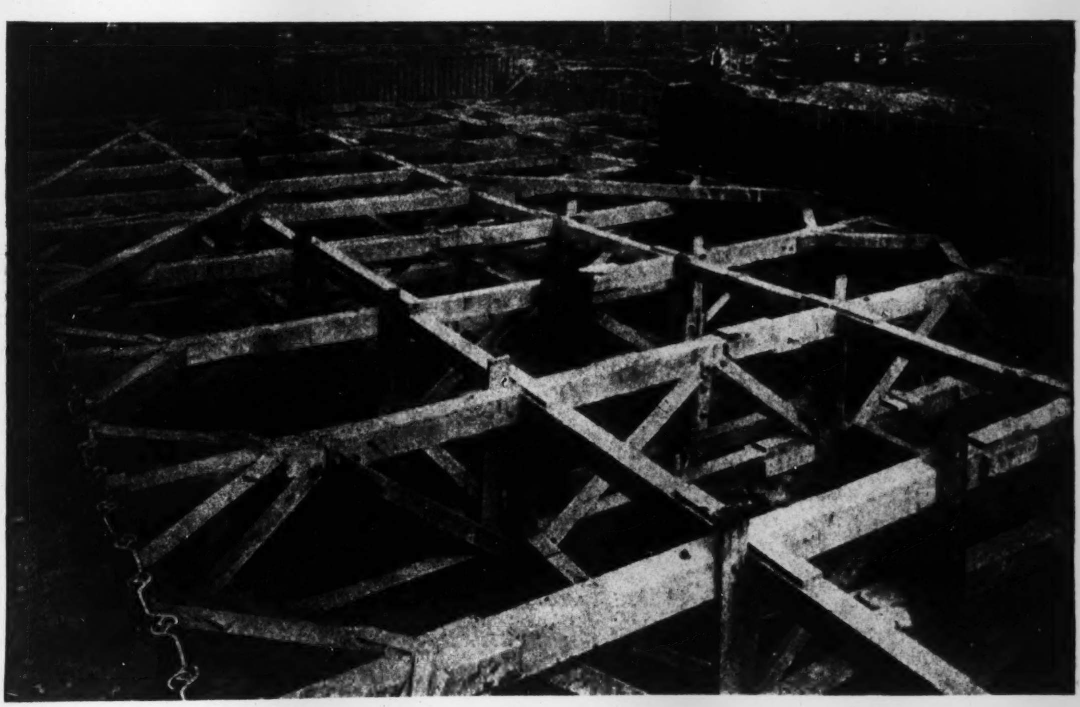
The new 40,000-kw. steam-electric power station of this company to furnish additional power for the city of Pittsburgh uses river water for condenser cooling, this water being carried to and from the river in double concrete tunnels approximately 300 feet long.

For the construction of the building and power unit foundations and the tunnels from the turbines to the river, the contractors, Sanderson & Porter, used 622 tons of Lackawanna 14-in. -by $\frac{3}{8}$-in. Lackawanna Arched-Web Sheet Piling in 40-foot lengths.

This sheet piling was driven through compact water-bearing sand and gravels and handled with care and accuracy.


331'
@110'
Screen House
Intake and Return Water Conduit
Lackawanna 14"x 3/8" Arched-Web Steel Sheet Piles
Filled Material
Pool Level - Elev. 733
U. S. Harbor Line - Elev. 737.5
Top of Bank
@250'
Boiler Room
Turbine Room





To sustain the weight of the bracing across this 55-foot wide trench, the steel sheet piles had to be driven before excavation, and as excavation progressed the cross timbers were bolted to the sheet piles for support, because the soil was of such a nature that timber piles could not be successfully driven to great enough depth.

The work was carried out under direction of W. [illegible]. Hamilton, Engineer in charge for the West Penn Power Co. and A. C. Polk, Construction Manager for Sanderson & Porter.

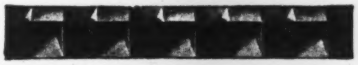
For power plant foundation work, especially in low wet soil and where condenser tunnels are to be constructed to some adjoining body of water, cofferdams of Lackawanna Steel Sheet Piling afford the safest and speediest method of construction. In many instances, having this steel sheet piling permanently in place gives an excellent permanent protection against weak soil flowing out from under the heavy loading of the machinery or building foundations.

Lackawanna Steel Sheet Piling has done its work so well in the construction of many of the largest modern American power plants, that its superiority for this purpose is a matter of common knowledge. Our engineers have a wealth of data on what has been and what can be accomplished in this type of construction, and their advice is free for the asking.

We Also Offer for Better Construction

Elcannes

Concrete Reinforcing Bars



The Elcannes Bar combines maximum bonding surface, minimum weight, and uniform strength. The bonding surface is 15 per cent greater than that of a plain square bar of equal nominal size. The cross-sectional area is practically the same at all points and the regular surface facilitates fabrication and handling.

The Elcannes Bar is equivalent in weight and area to the corresponding section of plain square bar.

Send for complete information.

DOUBLE-LOCK
LACKAWANNA
INTERLOCK

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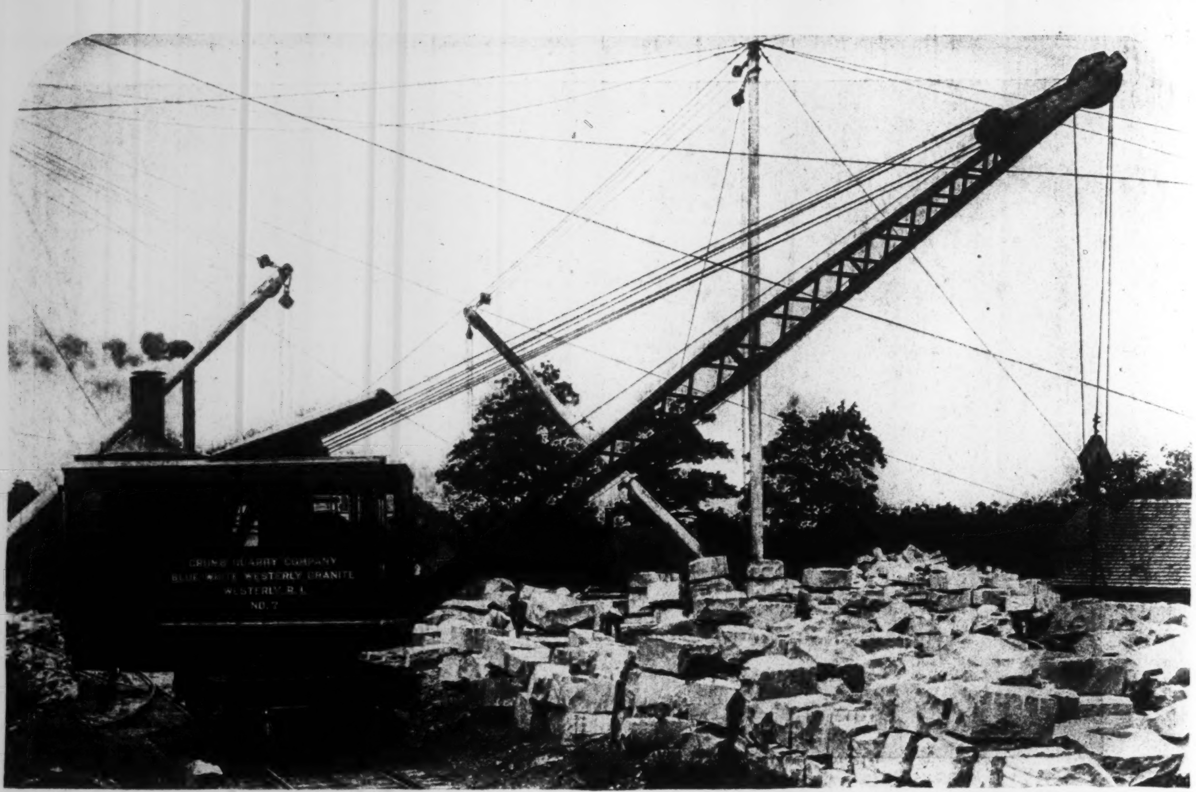
Sole Exporter for Other Countries: Consolidated Steel Corporation, 165 Broadway, New York.

492



"AMERICAN" Locomotive Cranes Built to Withstand the Severest Service

"AMERICAN" Locomotive Cranes are built to stand powerful strains, shocks, severe work and abuse. The first insurance of this is its racer or revolving deck which is a massive single-piece gun-iron casting.

Upon this crane deck casting, the boiler, engines, drums, hand levers, and other parts, are securely mounted in a compact and convenient manner. The drums and reversing gears are placed low down on crane deck, easy to get at.

The non-reversing, horizontal, double-cylinder, smooth running engines are constructed for maximum power and long use.

The controlling levers are plainly labeled and located well to front, away from heat of boiler, giving operator full view of load at all times.

The illustration above shows an "AMERICAN" Locomotive Crane that has been used by the Crumb Quarry Company, of Westerly, Rhode Island, for over four years with supreme satisfaction, and is in use today.

No matter where you are, an "AMERICAN" representative can reach you in twenty-four hours.

"Give me where I may stand and I will move the world."

American Hoist & Derrick Co.

Saint Paul Minnesota

Builders of "AMERICAN"

Hoisting Engines
Electric Hoists
Derricks

Locomotive Cranes
Railroad Ditchers
Logging Equipment

Sugar Cane Machinery
Marine Deck Machinery and Tackle
The Genuine "CROSBY" Wire Rope Clip

New York Chicago Pittsburgh Seattle New Orleans Detroit

AMERICAN
HOIST & DERRICK CO.

INSLEY STEEL DERRICKS

embody refinements of design and construction which

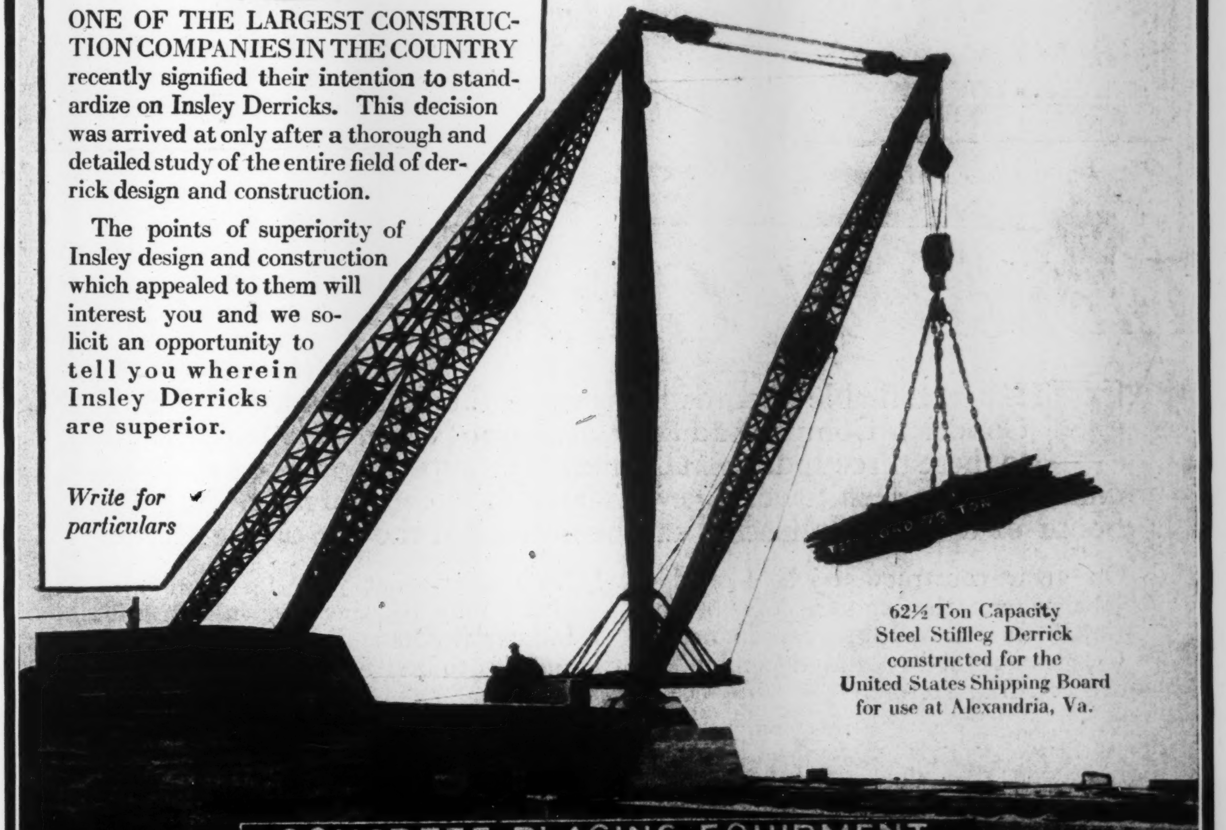
MERIT INVESTIGATION

INSLEY

ONE OF THE LARGEST CONSTRUCTION COMPANIES IN THE COUNTRY recently signified their intention to standardize on Insley Derricks. This decision was arrived at only after a thorough and detailed study of the entire field of derrick design and construction.

The points of superiority of Insley design and construction which appealed to them will interest you and we solicit an opportunity to tell you wherein Insley Derricks are superior.

Write for particulars

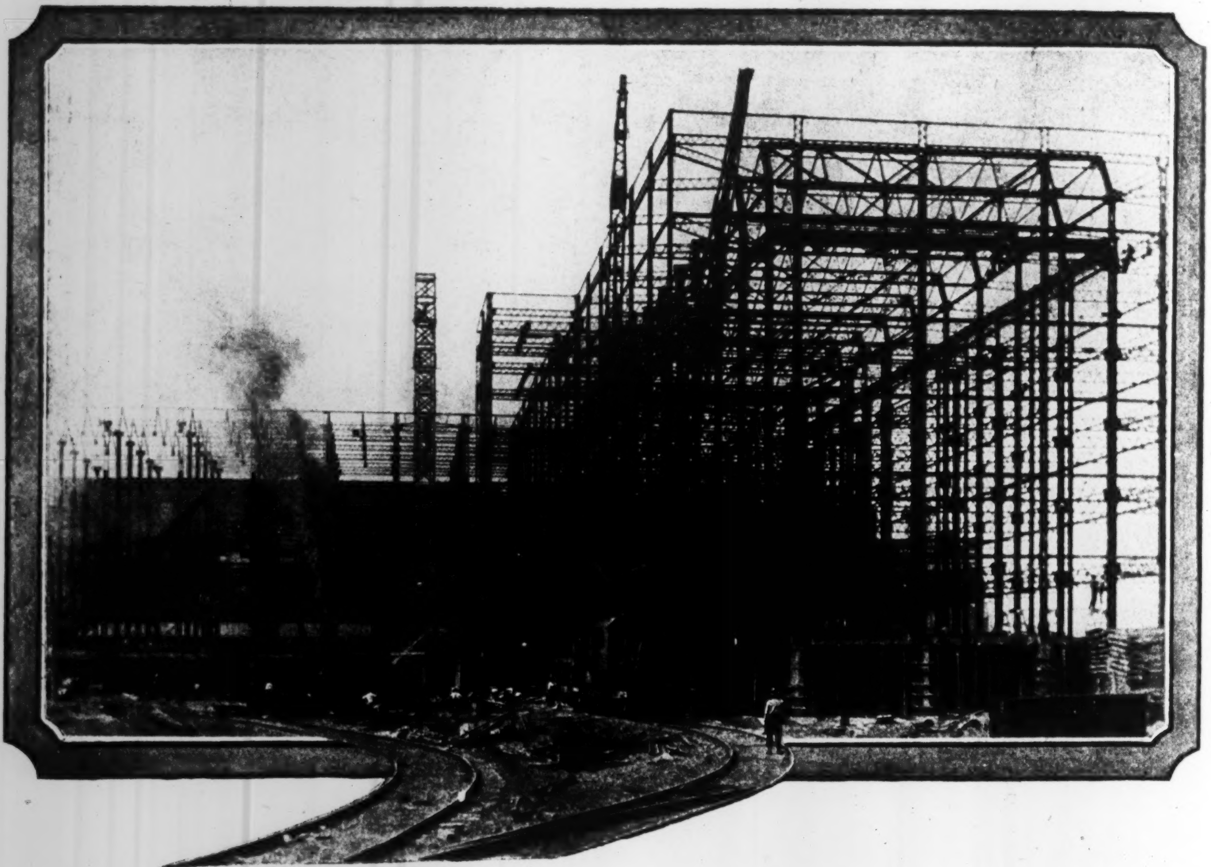


62½ Ton Capacity
Steel Stiffleg Derrick
constructed for the
United States Shipping Board
for use at Alexandria, Va.

CONCRETE PLACING EQUIPMENT
INDUSTRIAL CARS—DUMP BUCKETS

INSLEY MANUFACTURING CO.

Engineers INDIANAPOLIS, INDIANA. Manufacturers



Industrial Cranes of Course

THE remarkable records hung up in the fabrication of the B. F. Goodrich Company addition at Akron, Ohio, were partially due to these three Industrial Cranes. The super booms of two 60-ton cranes may be seen towering even above the steel roof members. The boom of a 30-ton Industrial can be noticed at the left of the picture.

On great construction jobs like this, jobs where the spectre of "behind time" must not approach, Industrial Crane adaptability and dependability are essential factors.

No matter what your lifting requirements may be, there is, in the wide Industrial Crane line, the exact type and size to best fill your need.

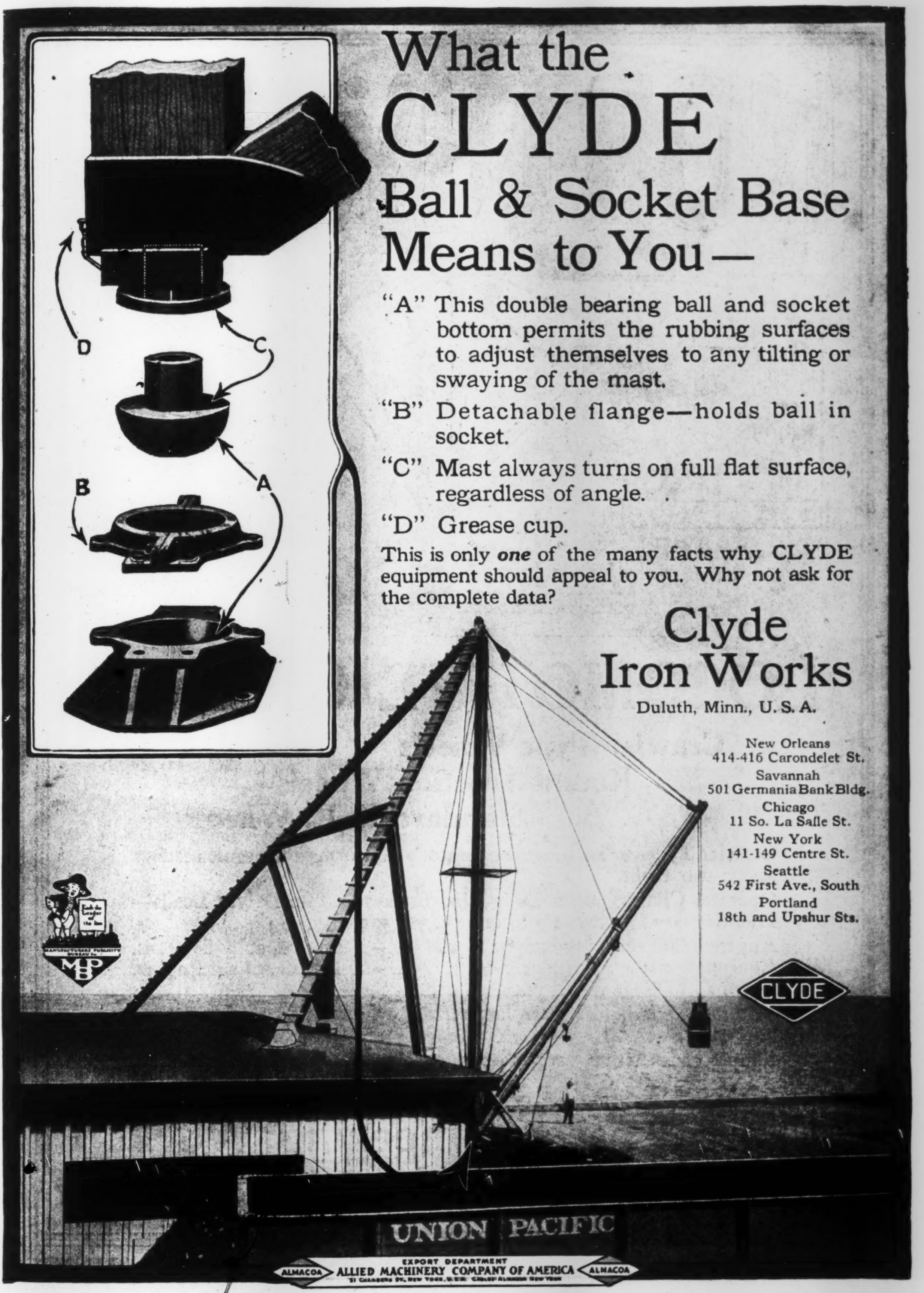
INDUSTRIAL WORKS, Bay City, Mich.

NEW YORK	PHILADELPHIA	DETROIT	CHICAGO
50 Church St.	Widener Bldg.	Book Bldg.	McCormick Bldg.

Agents: C. B. Davis Engineering Co., Birmingham, Ala.; J. G. Miller, St. Louis, Mo.; F. H. Hopkins Co., Montreal, Que; N. B. Livermore & Co., San Francisco, Calif.; Northwestern Equipment Co., Portland, Ore., and Seattle, Wash., Industrial Works.

Products: Locomotives, Erection and Wrecking Cranes, 5 to 160 tons capacity; Pile Drivers, Pillar Cranes, Transfer Cranes, Rail Saws.

Member of Material Handling Machinery Manufacturers' Association.



What the CLYDE Ball & Socket Base Means to You—

"A" This double bearing ball and socket bottom permits the rubbing surfaces to adjust themselves to any tilting or swaying of the mast.

"B" Detachable flange—holds ball in socket.

"C" Mast always turns on full flat surface, regardless of angle.

"D" Grease cup.

This is only *one* of the many facts why CLYDE equipment should appeal to you. Why not ask for the complete data?

Clyde Iron Works

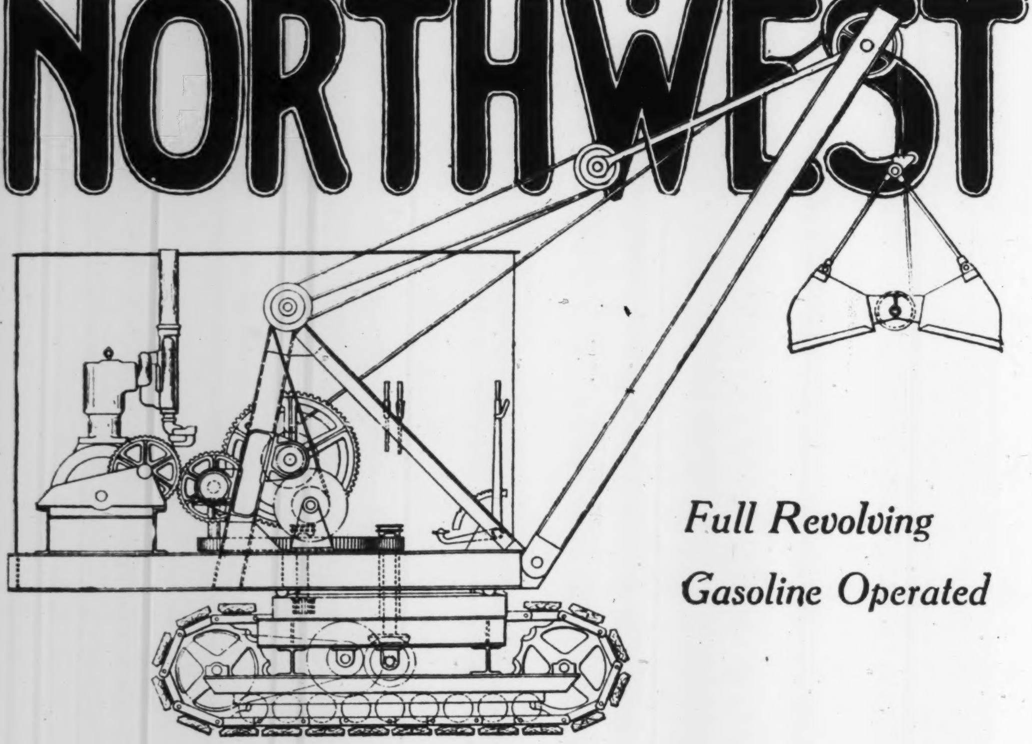
Duluth, Minn., U. S. A.

New Orleans
414-416 Carondelet St.
Savannah
501 Germania Bank Bldg.
Chicago
11 So. La Salle St.
New York
141-149 Centre St.
Seattle
542 First Ave., South
Portland
18th and Upshur Sts.

CLYDE

EXPORT DEPARTMENT
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
51 Chambers St., New York, U.S.A. Cables: Almacoa New York

NORTHWEST



Full Revolving

Gasoline Operated

LOCOMOTIVE CRANES

Crawler Type Wheels
Round Traction Wheels
Standard R. R. Wheels

Crawler Type steers from the operator's platform in the same manner as the war tanks.

Operates Clam Shell or Drag Line Bucket or Pile Driver Leads—Handles Grab Bucket up to one cu. yd. capacity.

Approximate shipping weight 30,000 lbs.—lifting capacity five tons. Equipped with 4-cylinder 7-in. x 9-in.—60-hp. Gasoline Engine. Boom 25 to 40 ft. Full enclosed cab.

Minimum number of gears, large size, slow moving, cut steel, bronze bushed.

Simple construction, easy to operate, all parts accessible.

Manufactured by

Northwest Engineering Works

General Sales Offices: 28 E. Jackson Blvd., Chicago

Phone Wabash 9326 **Works: Green Bay Wisconsin**

Thirty-four feet from the bottom of the cut to the car floor on which this Browning is dumping. Converted into a steam shovel, it has a long reach which enables it to do work not otherwise possible.

HERE the profit-making possibilities of a Browning Crane are graphically shown. Quickly converted into a steam shovel, it has reached a depth at which it would be impossible for an ordinary steam shovel to work.

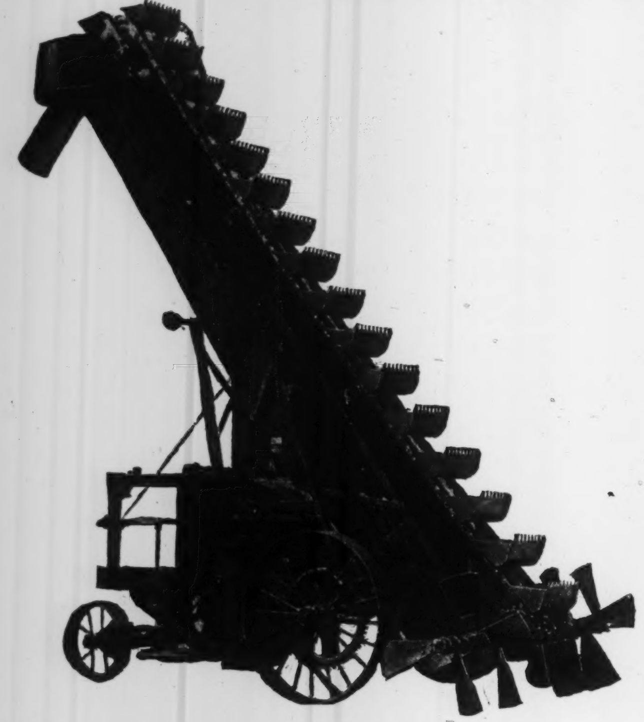
This feature of great adaptability is one of the big reasons why Browning Cranes are used by those who know them. Another reason is the fact that Browning Locomotive Cranes and Browning Buckets are the sole products of the Browning plant. Every energy of every executive, designing engineer and mechanic is directed solely toward the one goal, viz.: the production of the most efficient cranes and buckets it is possible to produce.

To find out how well they have succeeded, write for catalog and production figures on your own lines of work

THE BROWNING COMPANY, Cleveland, Ohio

New York	Seattle	SALES OFFICES	Los Angeles	Montreal
Chicago	Portland	Salt Lake City	San Francisco	Washington, D.C.

BROWNING
LOCOMOTIVE CRANES



BIGGEST *and* BEST HAISS

A Haiss-built Wagon Loader, like the type "Hercules Path Digging" shown in the illustration, has no equal, in either the United States or Europe. Its 16 feet height from the ground to the lower edge of the swivel spout, its self-propelled chassis with the one forward, the one backward drive, and the automatic low gear "crowding" speed, its patented self-feeding propellers which clean up a "path" wider than the machine while at the same time filling every bucket, and which entirely eliminate shovel labor—are features that HAISS has all combined into one large, powerful, portable, labor-aiding device. Haiss loaders have shown the way how the cheapest kind of loading, everything considered, can be done for the smallest amount of capital invested.

1 cu. yd. in 1 minute for 1c. of power with 1 man. These are the four great terms of a formula by which the success and reputation of all Haiss "Path-Digging" Wagon Loaders are sustained.

All mechanical facts in Booklet No.1119 Get one

Haiss Digging Buckets

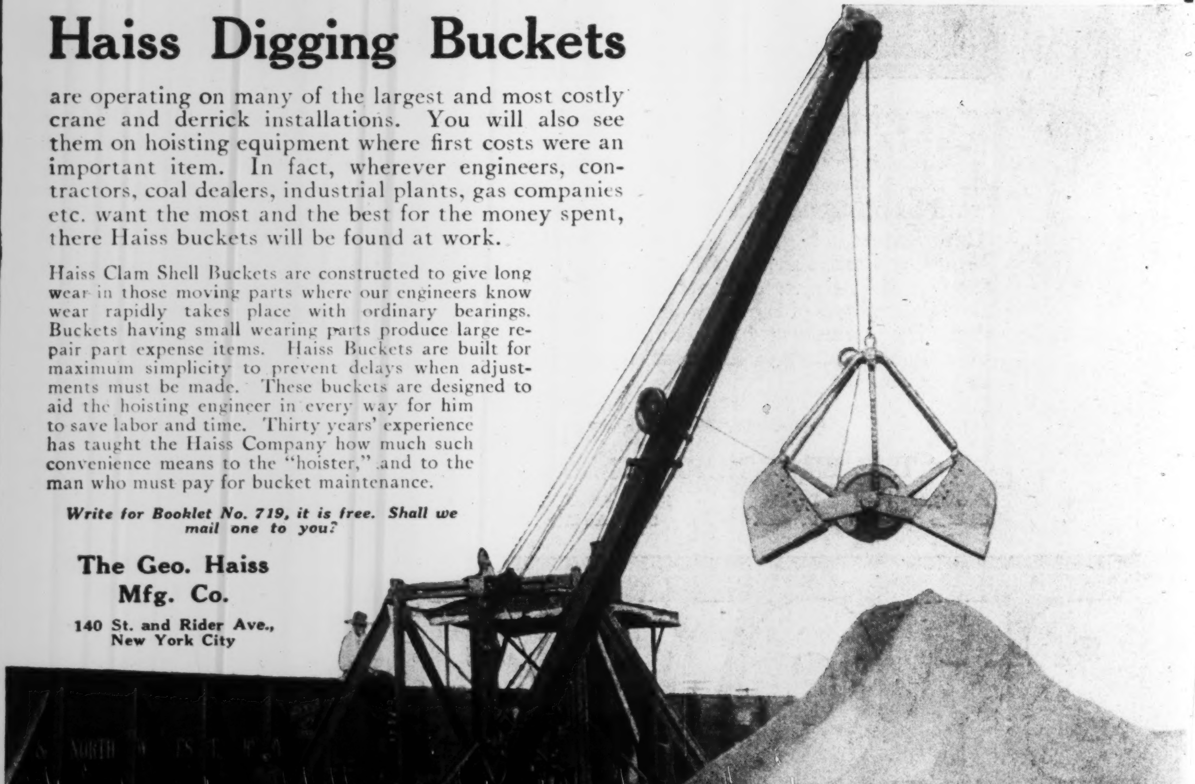
are operating on many of the largest and most costly crane and derrick installations. You will also see them on hoisting equipment where first costs were an important item. In fact, wherever engineers, contractors, coal dealers, industrial plants, gas companies etc. want the most and the best for the money spent, there Haiss buckets will be found at work.

Haiss Clam Shell Buckets are constructed to give long wear in those moving parts where our engineers know wear rapidly takes place with ordinary bearings. Buckets having small wearing parts produce large repair part expense items. Haiss Buckets are built for maximum simplicity to prevent delays when adjustments must be made. These buckets are designed to aid the hoisting engineer in every way for him to save labor and time. Thirty years' experience has taught the Haiss Company how much such convenience means to the "hoister," and to the man who must pay for bucket maintenance.

Write for Booklet No. 719, it is free. Shall we mail one to you?

The Geo. Haiss Mfg. Co.

140 St. and Rider Ave.,
New York City



Byers AUTO-CRANES

TRADE MARK BECKWITH PATENTS

Bigger Production With Fewer Men

That's a difficult combination facing road buiders today. Slower, costlier methods sufficed under a normal labor market—now you must "cut corners"—and a BYERS AUTO-CRANE is the machine to begin it with.

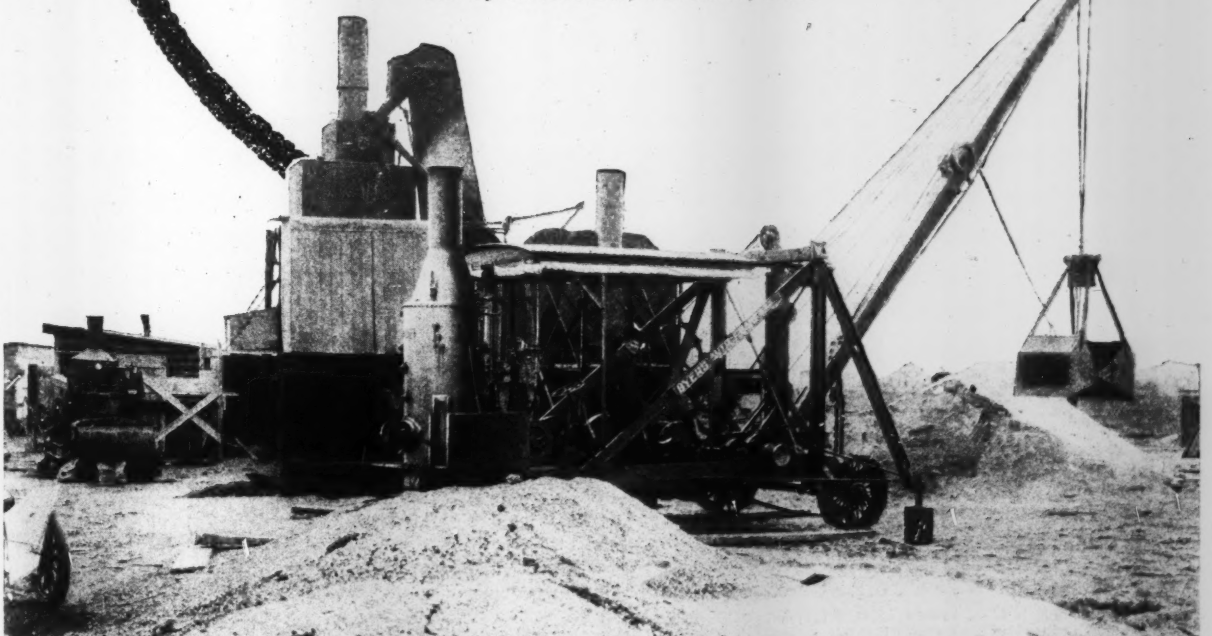
Speed, high boom, long reach and fast work in tight quarters are the distinctive features and insure bigger production with fewer men.

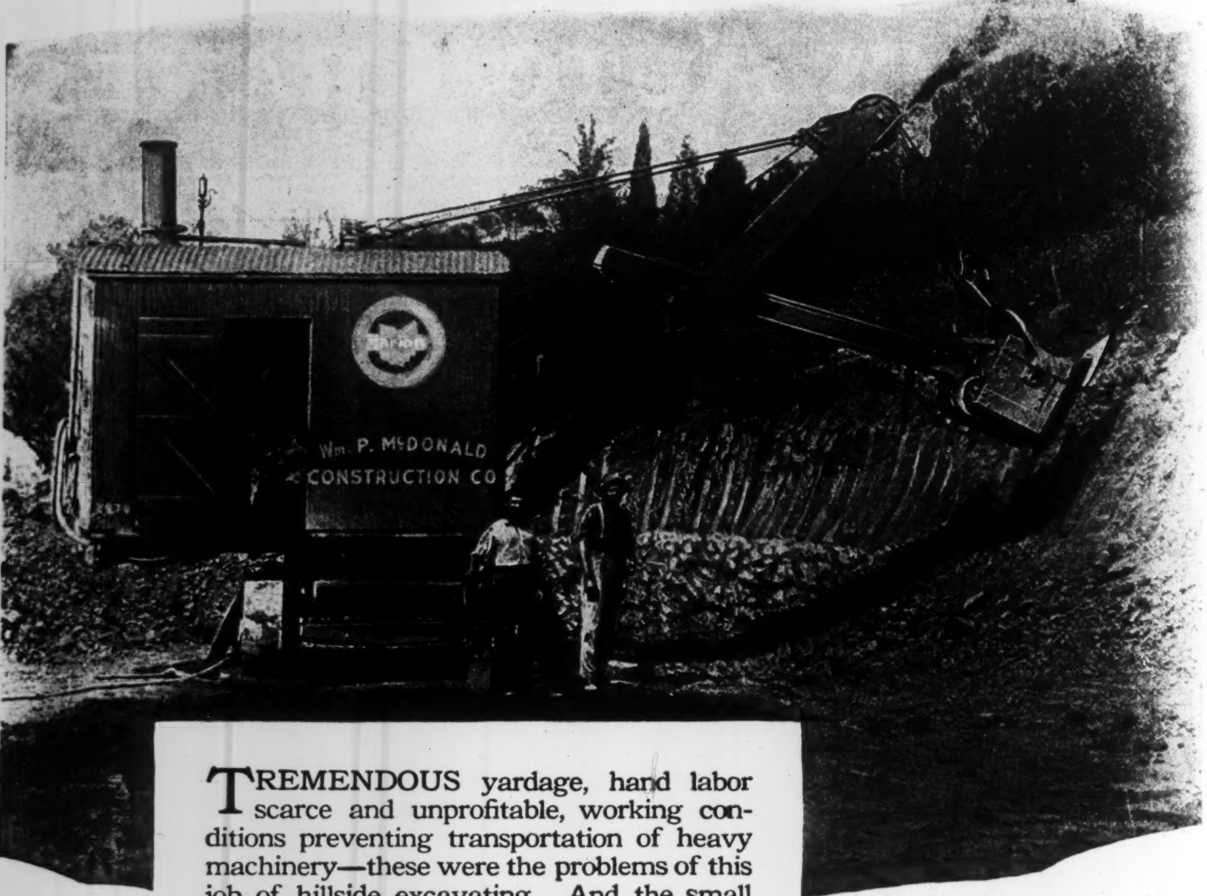
They are equipped with Road wheels, Rail Trucks or apron treads and designed for steam, gas or electric power.

Furnished with a Page ½ yd. Dragline scraper bucket for drainage and excavating work, or with Clamshell, Orange Peel, Magnet or Hook.

Write for bulletin 1020 today.

John F. Byers Machine Co.
250 Sycamore St., Ravenna, Ohio





Wm. P. McDonald Construction Company
Mt. Vernon, N. Y.

TREMENDOUS yardage, hand labor scarce and unprofitable, working conditions preventing transportation of heavy machinery—these were the problems of this job of hillside excavating. And the small Revolving "Marion" solved them all.

"Marions" are always on the job. They dig fast and steadily, move readily on their own power and do a clean, thorough job on both deep and shallow cuts.

For a third of a century "Marion" Shovels have pointed the way to better methods, quicker work and bigger profits on all kinds of excavating. Hundreds of honestly-built "Marions" are in successful use today on every excavating service.

The production of "Marion" Shovels has been speeded up and deliveries advanced by our policy of confining production to standard popular models and building more of those. Write us today about your work—we'll gladly furnish estimate and delivery date.

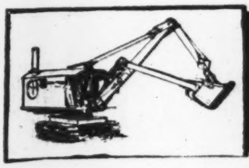
THE Marion STEAM SHOVEL CO.

EVERYWHERE-RELIABLE
The Marion Steam Shovel Co.
ESTABLISHED 1884

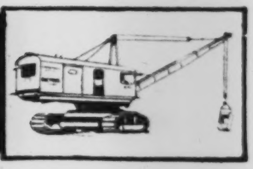
Established 1884 Marion, Ohio

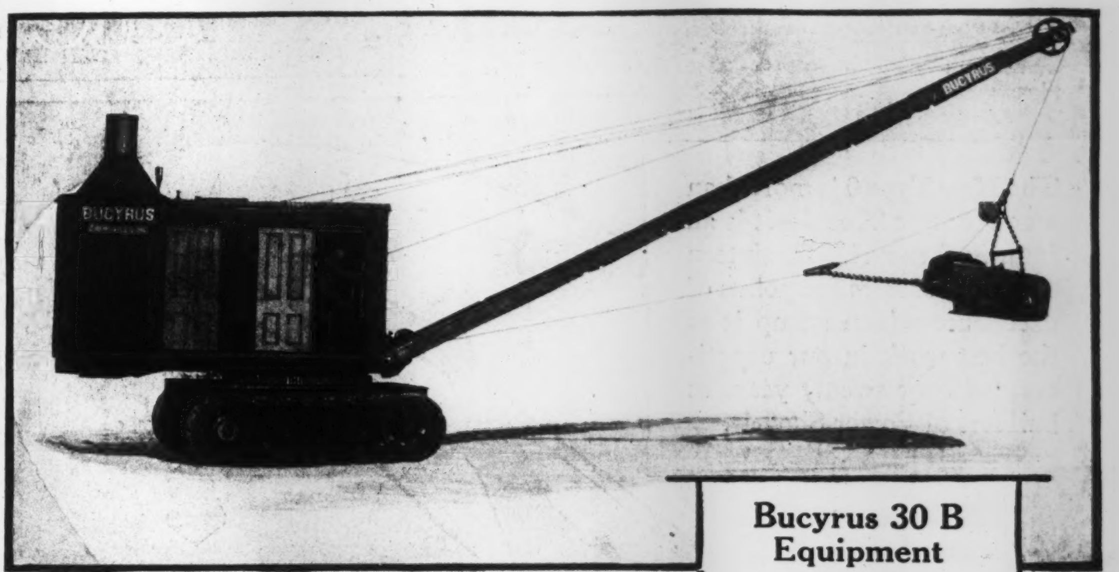
New York Chicago Atlanta San Francisco

Billings, Mont., F. B. Connelly Co
Dallas, F. B. Wright, Bush Bldg.
Denver, H. W. Moore & Co.
Detroit, W. H. Anderson Tool & Sup. Co.
Philadelphia, H. L. Cox, 13th & Cherry Sts.
Pittsburgh, J. W. Patterson
Portland, Clyde Equipment Co.
Salt Lake City, H. W. Moore & Co.
Seattle, Clyde Equipment Co.
Vancouver, Vancouver Mach. Depot, Ltd.
Montreal, Toronto, F. H. Hopkins & Co., Ltd.



BUCYRUS





30 B DRAGLINE EXCAVATOR

More than a dragline—this 30-B Dragline excavator (illustrated above), is a universal machine.

The design incorporates many new and improved features, based on nearly forty years of steam shovel experience.

Care has been given to such details as convenience and ease of operation and accessibility. A perfected and simplified caterpillar traction mounting has been developed. Steel treads, direct gear drive, simple, sturdy design.

Mounting readily changeable to railroad trucks or traction wheels if desired.

None of those functions peculiar to any one type of machine have been sacrificed in developing this universal machine. Its scope of work is practically unlimited. Send for Bulletin C-301-N.

BUCYRUS COMPANY

So. Milwaukee, Wisconsin

BRANCH OFFICES:

Chicago New York Denver Portland, Ore. Minneapolis
Birmingham San Francisco Cleveland Salt Lake City London, Eng.

Bucyrus 30 B Equipment

DRAGLINE EXCAVATOR

1-yd. bucket, 35-ft. boom.

¾-yd. bucket, 40-ft. boom.

REVOLVING SHOVEL

1-cu.yd. dipper (level full).

CLAM SHELL EXCAVATOR

1-yd. clam shell bucket, 35-ft. boom.

¾-yd. clam shell bucket, 40-ft. boom.

CRANE

9¾ tons capacity at 20 ft. (on caterpillars).

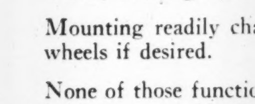
9 tons capacity at 20 ft. (on railroad trucks or traction wheels).

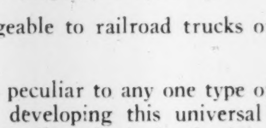
SEWER EXCAVATOR

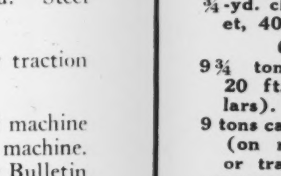
¾-yd. dipper, 30-ft. handle, 20-ft. trench.

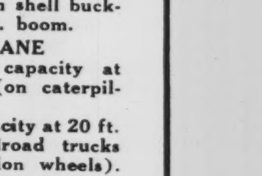
¾-yd. dipper, 24-ft. handle, 14-ft. trench.

230



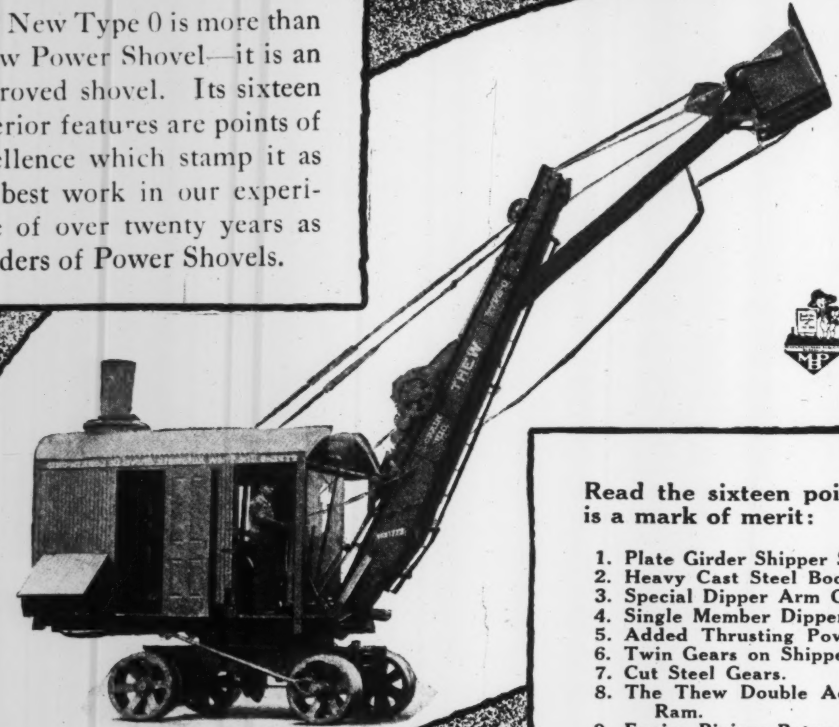






The New Type 0 Thew and It's 16 Superior Features

The New Type 0 is more than a new Power Shovel—it is an improved shovel. Its sixteen superior features are points of excellence which stamp it as the best work in our experience of over twenty years as builders of Power Shovels.



Read the sixteen points—each is a mark of merit:

1. Plate Girder Shipper Shaft Boom.
2. Heavy Cast Steel Boom Hinges.
3. Special Dipper Arm Guides.
4. Single Member Dipper Stick.
5. Added Thrusting Power.
6. Twin Gears on Shipper Shaft.
7. Cut Steel Gears.
8. The Thew Double Acting Steam Ram.
9. Engine Pinions Between Bearings.
10. The Thew Power Steer.
11. Reinforced Truck Frame.
12. The Thew Center Pin.
13. Swivel Axle Supports.
14. Round Edged Reinforced Truck Wheels.
15. Jaw Clutches on Axle.
16. Perfect Balance.

There is a story behind each of the above points. Get the full details. We shall be glad to send you a special bulletin on the New Type 0 Thew.

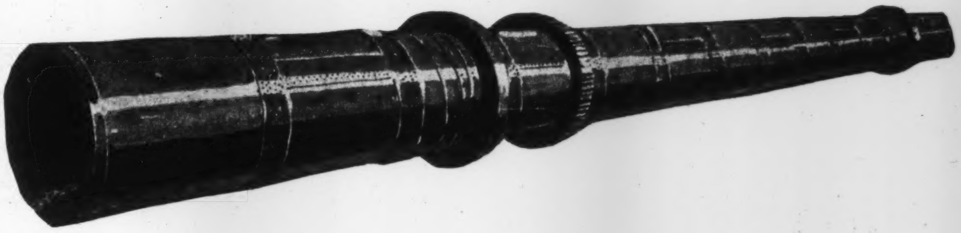
Thew manufactures a complete line of Power Shovels and Cranes—steam, gas and electric—for all classes of work. Dipper capacities ½ to 2 cubic yards. Cranes 3 to 7½ tons.

The Thew Automatic Shovel Co.
Lorain, Ohio
New York: 30 Church St. Chicago: Monadnock Block

THEW Power Shovels

EXPORT DEPARTMENT
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
51 Chambers St., New York, U.S.A. Cables: Almacoa New York

VULCAN
Rotary Kilns



Fuel Oil Fired Kilns

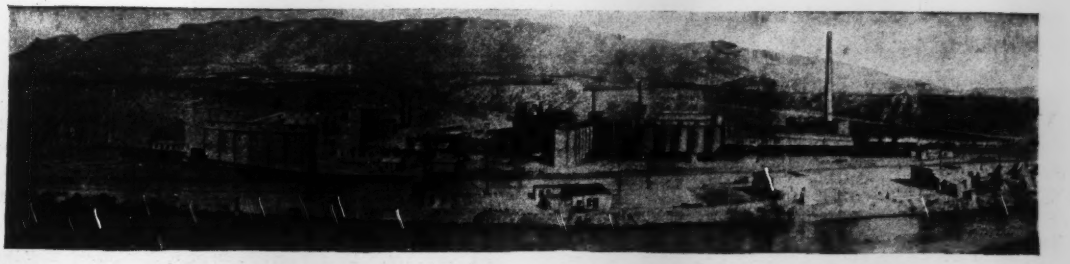
Fuel supply conditions frequently make the use of oil preferable to coal or gas in rotary kilns for manufacturing cement, burning lime, calcining dolomite, or in other processes involving the use of rotary kilns as one of the steps in economical production.

Numerous VULCAN Rotary Kilns have been built to use oil as the fuel. Our engineering staff is prepared to co-operate with yours in designing any type of rotary kiln best adapted to the process for which it is to be used and to the fuel limitations.

VULCAN Rotary Kilns are used in a great variety of industrial processes.

VULCAN IRON WORKS
Designers and Builders of Rotary Kilns for 20 or more years
1737 Main St., Wilkes-Barre, Pa.

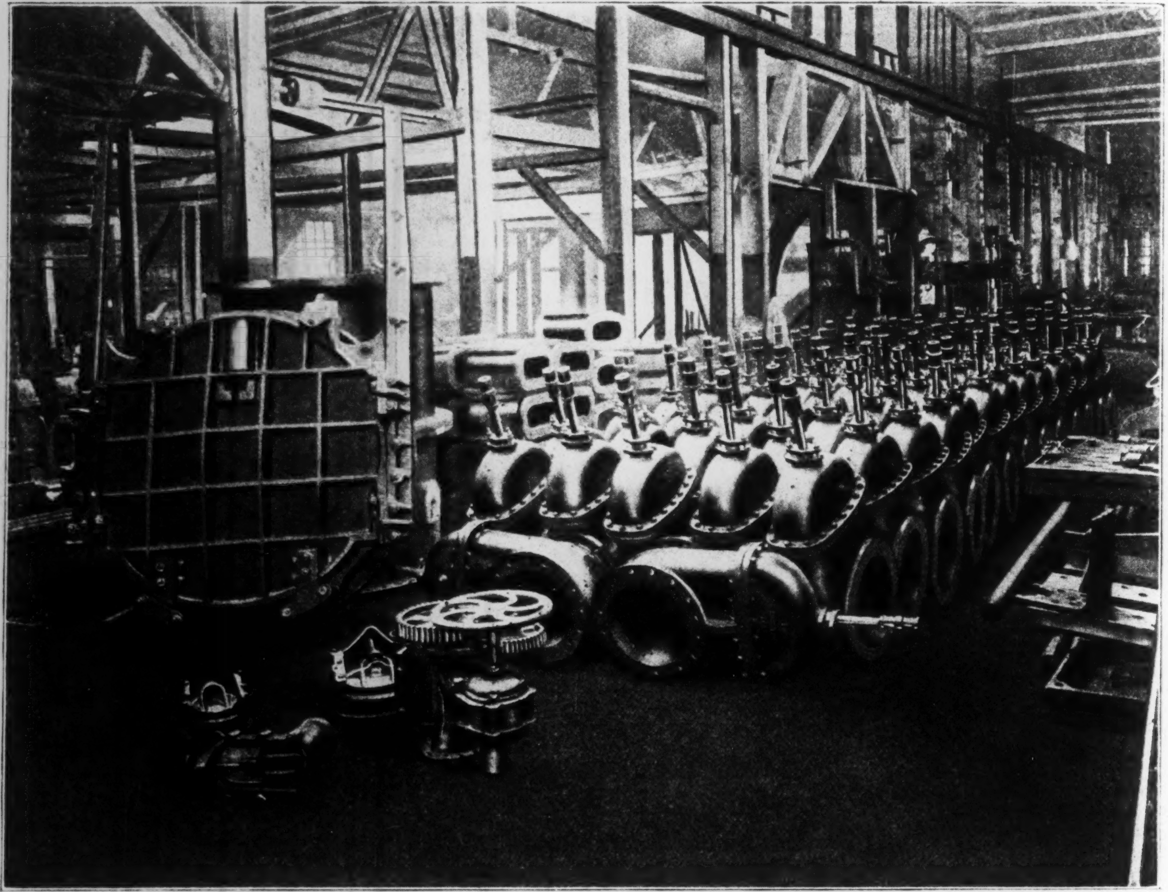
VIW



General view of plant of Southwestern Portland Cement Co., El Paso, Texas

COFFIN VALVE COMPANY,

Makers of the Largest Sluice and Gate Valves in America.



140 eighteen inch special gate valves

to control floating dry-docks, were ordered from us by the U. S. Shipping Board, Emergency Fleet Corporation. Part of this order is shown above. It speaks well for Coffin Products when they are ordered in this manner. It speaks well for our Engineering Service when you know that it can cope with any problems of water control, big or little. Have you copies of our Bulletins?

Office and Works, Neponset, Suburb of

Check Valves
Flap Valves
Foot Valves
Sewer Gates

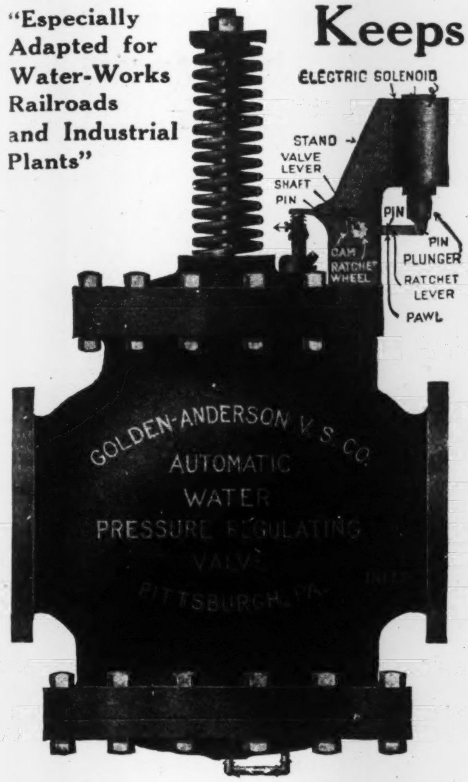
BOSTON, MASS.,

Sluice Gates
Gate Valves
Butterfly Valv
Fire Hydrants

REPRESENTATIVES:

New York City: C. W. Bergen, 256 Broadway
Cleveland, Ohio: Tomlinson Steam Specialty Co., Wade Building
Philadelphia, Pa.: DeHuff & Hopkins, Morris Building
San Francisco, Calif.: Theo. F. Dredge, Monadnock Building

"Especially Adapted for Water-Works Railroads and Industrial Plants"



Keeps the Water Pressure Constant on the Delivery Side—

Here is one Valve that will stop surges and fluctuations in your distributing lines—stop them permanently—and save many times the cost, in operating and maintenance expenses. It is one of the several types of

GOLDEN-ANDERSON

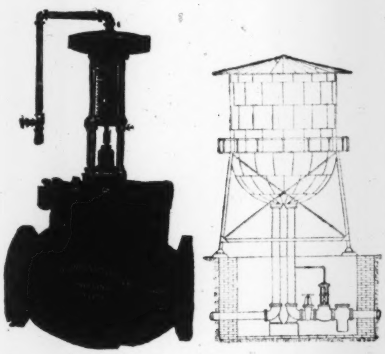
Patent Cushioned Water Pressure Regulating Valves

1. Positive in action and always dependable.
2. Perfectly cushioned by water and air both in opening and closing.
3. Fitted with electric solenoid that enables the valves to be opened wide from distant point in case of fire or other emergency.

← ***This shows the electrically operated type***

4. Again closing the circuit for a few seconds will automatically restore the valves to normal position.
5. Provided with special safety operating piston making the accidental entrance of high pressure into the low pressure side impossible.
6. Easily adjusted to deliver the desired pressure from the outside.
7. All water passages are large to prevent danger of clogging.
8. Made in sizes to 24 inches.
9. Correct in every detail and virtually indestructible.

Furnished with or without Solenoid attachment.



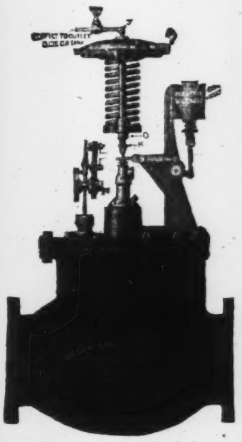
GOLDEN-ANDERSON

Patent Automatic Cushioned Controlling Altitude Valves

1. Automatically insure a constant water level in reservoirs, standpipes and tanks.
2. Operate without floats or fixtures, inside or outside of tank.
3. Three ways of closing—by water—by electricity—by hand.
4. Can be connected to work "both ways" on single pipe line.

GOLDEN-ANDERSON

Patent Automatic Cushioned "Stop-Starter Electric" Controlling Altitude Valves

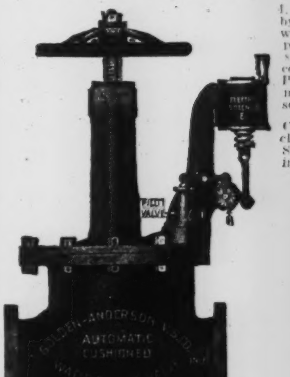


Automatically control the starting and stopping of motor driven pumps in connection with standpipes reservoirs and water tanks. Actuated by water pressure—and work under high or low pressure. Solenoid furnished for alternating or direct current. Will also operate warning bells and signal lights. May be electrically controlled from remote points. "No floats or fixtures"—"No water hammer or shock"—"No metal-to-metal seats." No waste or expensive current consumption.

GOLDEN-ANDERSON

Patent Cushioned Electric Water Service Valves

1. Enable you to build up and hold the water pressure in your distribution system in case of fire right from the pumping plant.
2. Operated by electrical solenoid, controlled from the plant regardless of distant location of the valves.
3. The valves are reclosed or opened by closing a small switch and holding it closed for a few seconds only. There can therefore be no waste of current.



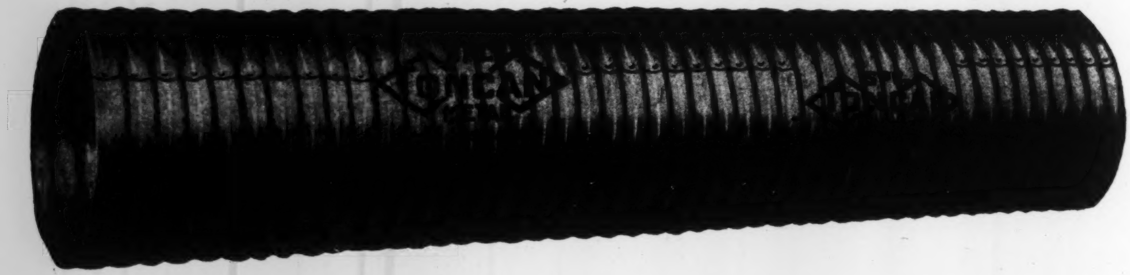
4. Cushioned by both air and water. No pounding, sticking or excessive wear. Positively no metal-to-metal seats.

Can also be closed by hand. Sizes to 24 inches.

"Hosts of References" "Every Valve with an Absolute Guarantee"

Golden-Anderson Valve Specialty Co., 1202 Fulton Bldg., Pittsburgh, Pa.

Toncan Metal for Lasting Culverts



Better Culverts For Better Roads

SPC.
TONCAN
METAL

STEEL Culverts have a great many advantages. They are economical, light, easy to handle and install, strong and efficient.

Toncan Metal Culverts have all the advantages of steel with one important added advantage—they are more durable, longer lived and therefore cost per year of service considered most economical.

Toncan Metal is a dense uniform sheet good all the way through, which carries a heavy tight coat of galvaning. Every sheet is inspected at the mill and only perfect sheets are permitted to go on the market.

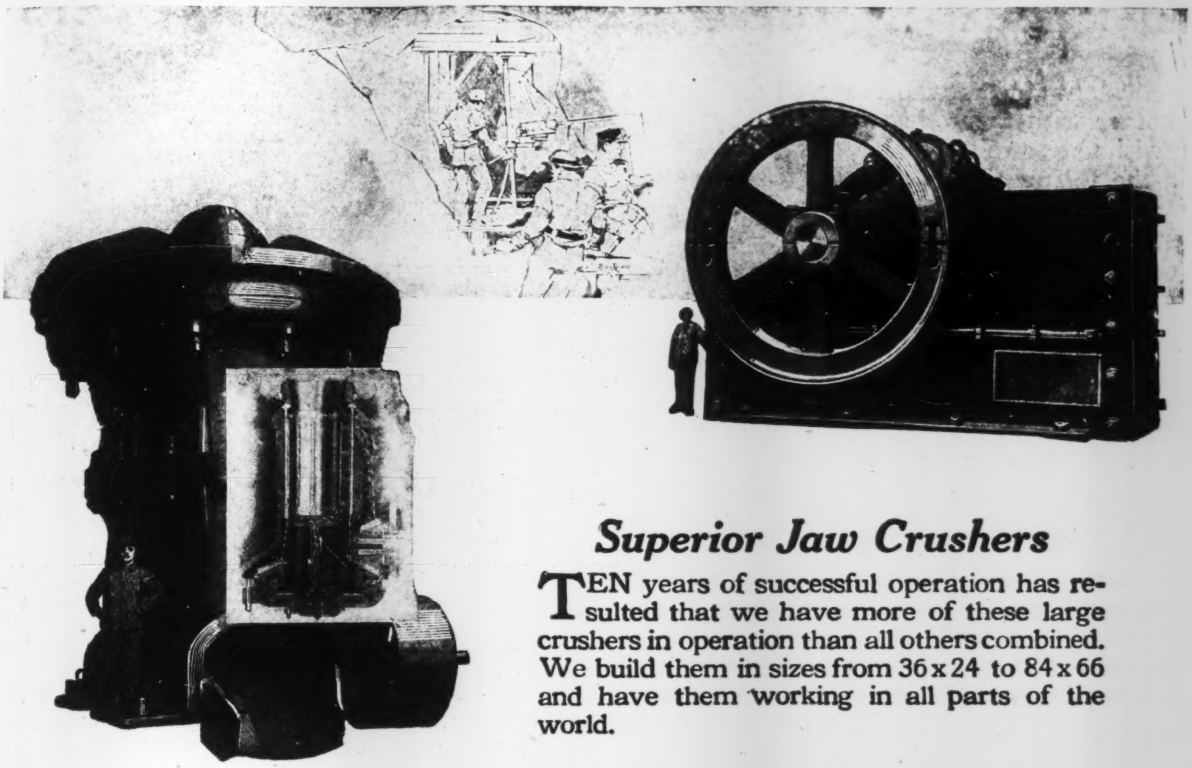
Toncan Metal is made to withstand exposure to the elements and resist corrosion.

To get the best results specify Toncan when ordering metal culverts.

Write us for the name of the nearest culvert manufacturer making culvert from Toncan Metal.

THE STARK ROLLING MILL COMPANY, Canton, Ohio
Sole Manufacturers of Toncan Metal

WORTHINGTON ROCK CRUSHING MACHINERY



Superior Jaw Crushers

TEN years of successful operation has resulted that we have more of these large crushers in operation than all others combined. We build them in sizes from 36 x 24 to 84 x 66 and have them working in all parts of the world.

Superior McCully Gyratory

SEVEN years of successful operation and over 300 installations in operation on Lime Stone, Trap Rock and hard Iron Ore, prove this machine a good buy. It embodies patented construction features and is built in sizes from 8" to 50" opening.

Both Superior McCully and Superior Jaw Crusher are the original machines of their type and are built at our great Power and Mining works at Cudahy, Wis.

Other Worthington Products

Centrifugal and Power Pumps
Large Water Works Pumps
Water Wheels, Air Compressors
Gasoline Engines, Meters
Jaw Crushers, Gyratory Crushers
• Oil Engines

WORTHINGTON PUMP AND MACHINERY CORPORATION
***Executive Offices:* 115 Broadway, New York City**
Branch Offices in 24 Large Cities

PUMPS—COMPRESSORS—CONDENSERS—OIL & GAS ENGINES—METERS—MINING—ROCK CRUSHING & CEMENT MACHINERY

WORTHINGTON

Deane Works, *Holyoke, Mass.*
Blake & Knowles Works
East Cambridge, Mass.
Worthington Works
Harrison, N. J.

Epping-Carpenter, *Pittsburgh, Pa.*

Laidlaw Works, *Cincinnati, Ohio.*

Gas Engine Works, *Cudahy, Wis.*
Power & Mining Works
Cudahy, Wis.
Snow-Holly Works
Buffalo, N. Y.

Eighty Pages of Up-To-The-Minute Information on Jeffrey Belt Conveyers

Practical Engineers who haven't time to bother with theoretical text matter but wish to go straight to the result will find the Jeffrey Catalog on Belt Conveyers of great value, because it gives them what they want—the answer—at a glance.

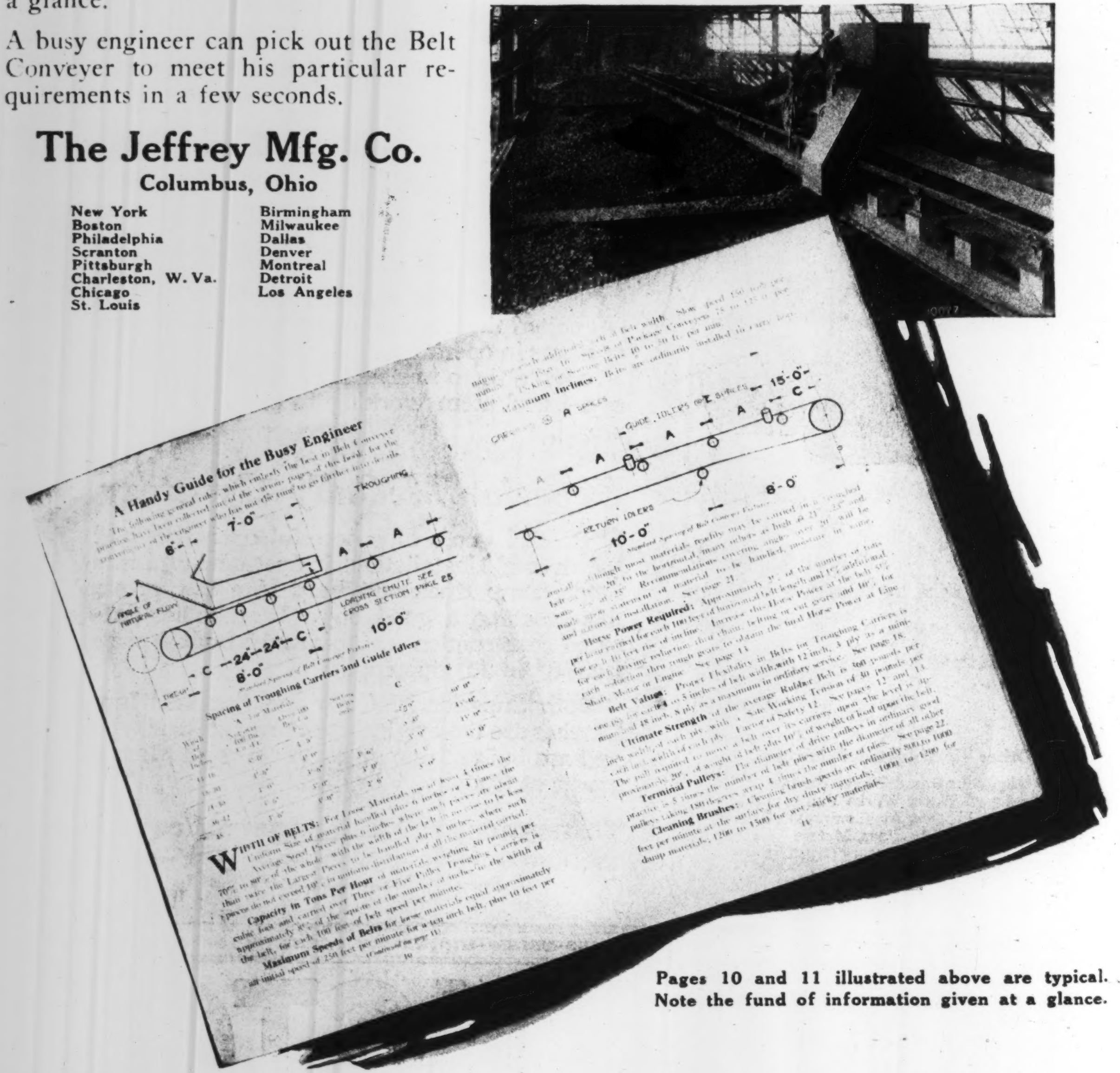
A busy engineer can pick out the Belt Conveyer to meet his particular requirements in a few seconds.

The Jeffrey Mfg. Co.
Columbus, Ohio

New York	Birmingham
Boston	Milwaukee
Philadelphia	Dallas
Scranton	Denver
Pittsburgh	Montreal
Charleston, W. Va.	Detroit
Chicago	Los Angeles
St. Louis	

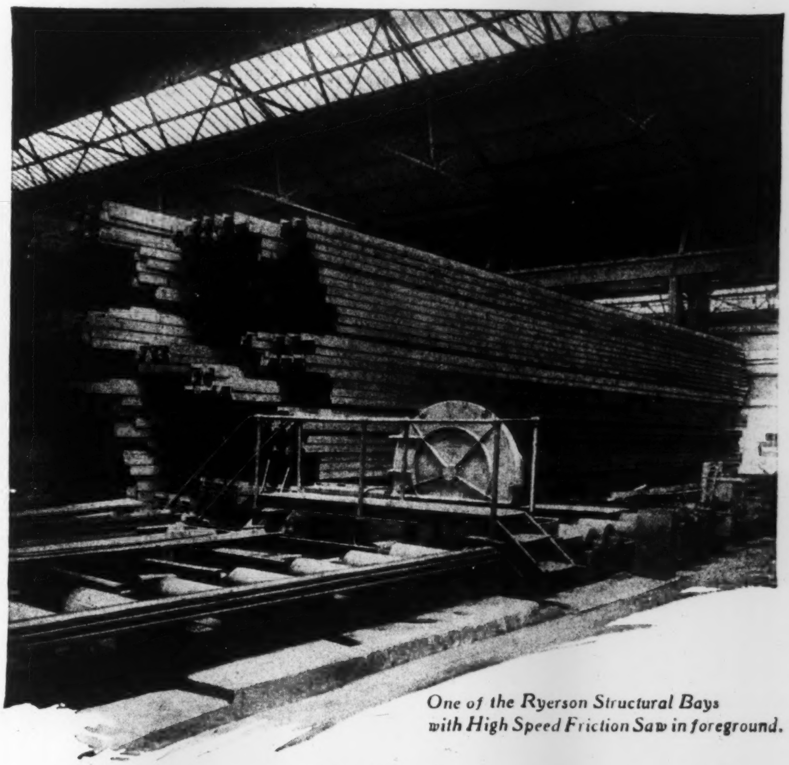
Every engineer of every industrial plant should have one of these catalogs in his working files all the time. Isn't it worth postage to see what it looks like? Your copy is waiting; write for Catalog No. 175-B.

Showing how the JEFFREY Belt Conveyer automatically and uniformly fills large bins or storage space.


A Handy Guide for the Busy Engineer
7'-0"
6'
TROUGHING
A
A
LOADING CHUTE SEE CROSS SECTION PAGE 25
C
24"
24"
8'-0"
10'-0"
Spacing of Troughing Carriers and Guide Idlers
WIDTH OF BELTS
Capacity in Tons Per Hour
Maximum Speeds of Belts
Maximum Inclines
GUIDE IDLERS
15'-0"
RETURN IDLERS
8'-0"
10'-0"
Horse Power Required
Belt Values
Ultimate Strength
Terminal Pulleys
Cleaning Brushes

Pages 10 and 11 illustrated above are typical. Note the fund of information given at a glance.

Handle it Mechanically



One of the Ryerson Structural Bays with High Speed Friction Saw in foreground.

Immediate Steel

Five Ryerson Steel-Service Plants maintain large and comprehensive stocks of the products of all the mills from the heaviest structural to the lightest bar, sheet or rivet.

Every product meets the standard specification of its class. Every product is stored in rooms or space especially provided to preserve its quality and finish.

High powered, accurate equipment is used and no effort is spared in making immediate shipments.

The unequalled Ryerson reputation, built up through over three-quarters of a century of business, protects every Ryerson customer.

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ESTABLISHED 1842 INCORPORATED 1888

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IRON STEEL MACHINERY

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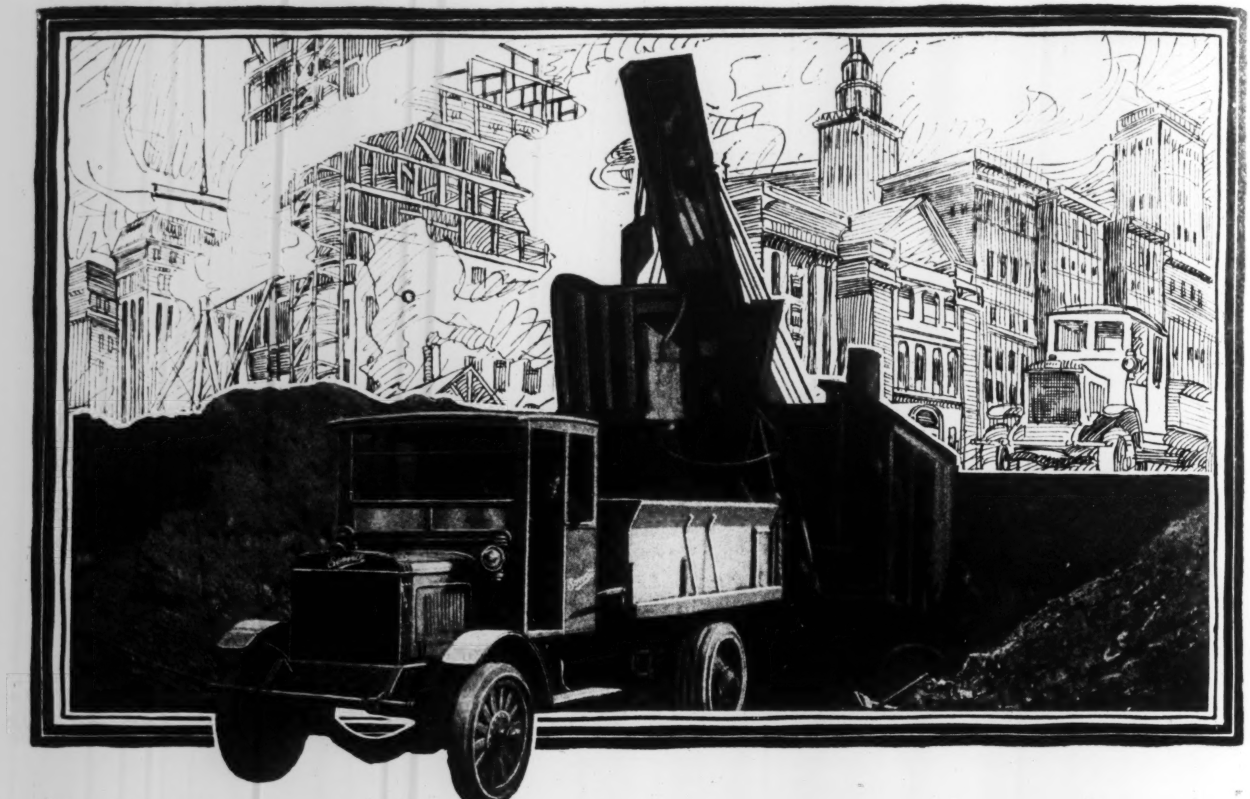

Consistent, Unfailing Performance

Sturdy of construction—a world of power and maximum economy of operation and upkeep. Carrying capacity loads over uneven roads with mud axle deep—standing up under tons of weight suddenly dropped by the steam shovel, *Service* Motor Trucks equipped with dump and other specialized bodies have demonstrated their ability to accomplish heavy duty work with consistent, unfailing performance, uninterrupted by costly delays.

And service after sale is a most valuable factor—as much a part of a *Service* sale as the truck itself.

Service Motor Trucks are built in 80 different combinations of power, speed and capacity, from which to choose the one best suited to your exact requirements.

Write for bulletin covering the use of trucks in the contracting field.

SERVICE MOTOR TRUCK CO., Wabash, Indiana

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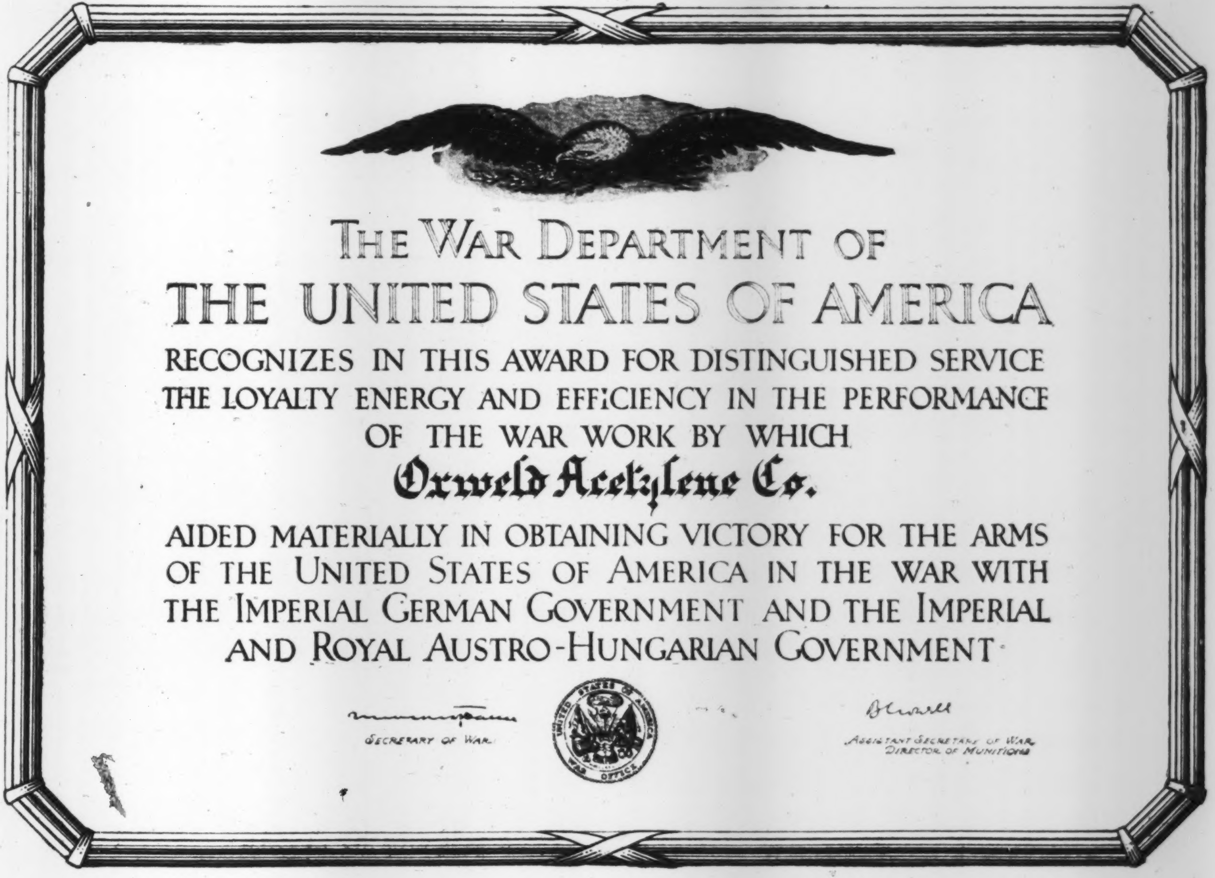

THE WAR DEPARTMENT OF
THE UNITED STATES OF AMERICA
RECOGNIZES IN THIS AWARD FOR DISTINGUISHED SERVICE
THE LOYALTY ENERGY AND EFFICIENCY IN THE PERFORMANCE
OF THE WAR WORK BY WHICH
Oxweld Acetylene Co.
AIDED MATERIALLY IN OBTAINING VICTORY FOR THE ARMS
OF THE UNITED STATES OF AMERICA IN THE WAR WITH
THE IMPERIAL GERMAN GOVERNMENT AND THE IMPERIAL
AND ROYAL AUSTRO-HUNGARIAN GOVERNMENT

SECRETARY OF WAR

ASSISTANT SECRETARY OF WAR
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Another O. K. on a Good Product

"FOR making prompt deliveries and otherwise co-operating with the Construction Division of the Army."

So runs the citation for which this award was made.

The great Oxweld organization which kept Uncle Sam steadily supplied with welding and cutting apparatus during traffic-tied days of war is once more devoting its entire energies to the needs of welders and cutters throughout America.

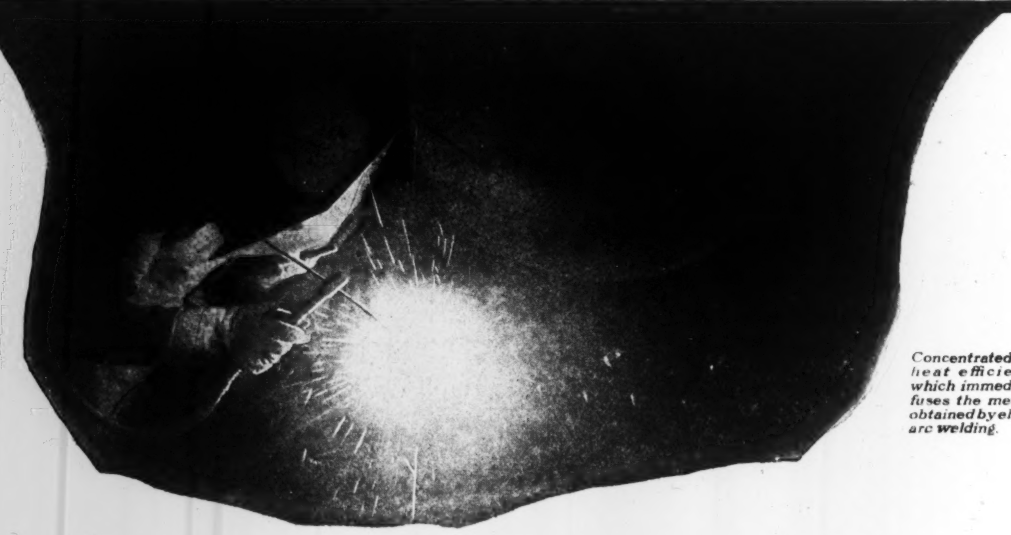
It is, indeed, amplified, improved and of greater scope because of its war experience.

In peace as in war, Oxweld has but one standard of product and service.

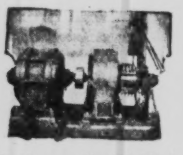
OXWELD ACETYLENE COMPANY
NEWARK, N. J. CHICAGO SAN FRANCISCO
World's Largest Maker of Equipment for Oxwelding and Cutting Metals

O-524

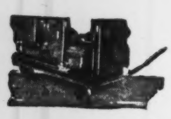
Progressive Industry quickly gives preference to the process which can show its advantages over other methods—the modern way is to do it electrically



Concentrated high heat efficiency, which immediately fuses the metal, is obtained by electric arc welding.



Stationary Arc Welding Set is easily installed for operation



Portable Arc Welding Set permits of maximum use

Other G-E Industrial Heating Equipment:

Tilting Type Electric Brass Melting Furnace—2250 lbs. per hour

Self-Regulating Bench Type Electric Melting Pot for metals—Bulletin 69703

Electric Rivet Heater is essential to quick work well done—Bulletin 69701

Electric Soldering Iron—Production Helps in Booklet B-3514

Utilize electric heat to the utmost

The essential value of electric heating equipment to modern industrial development is apparent in the large demand for various installations of this order to meet increased production schedules.

Slow and laborious processes which retard production must give way to units that employ electric heat—and one of the most essential of the improved methods is *electric arc welding.*

Electric arc welding maintains advantages in quantity, quality, and cost—wherever iron or steel is to be joined in repair work, salvage, or original manufacture. The utilization of its possible applications extends over steel and iron works—boiler shops—foundries—repair shops—machine shops—and innumerable other industries.

An unusual simplicity and elasticity of operation has been perfected in the designs of Stationary and Portable Arc Welding Sets manufactured by the General Electric Company. This equipment can be provided for either group or single operator service, and generator can be driven by any source of power—engine, belt, d-c. or a-c. motor. Send for Bulletin 48932-A.

To stimulate correct operation, the General Electric Company has established an Arc Welding School at Schenectady, which offers exceptional training in horizontal, vertical, and overhead welding under actual production conditions—free to a limited number of men. Bulletin No. 48953 sent on request.

General Electric Company

General Office
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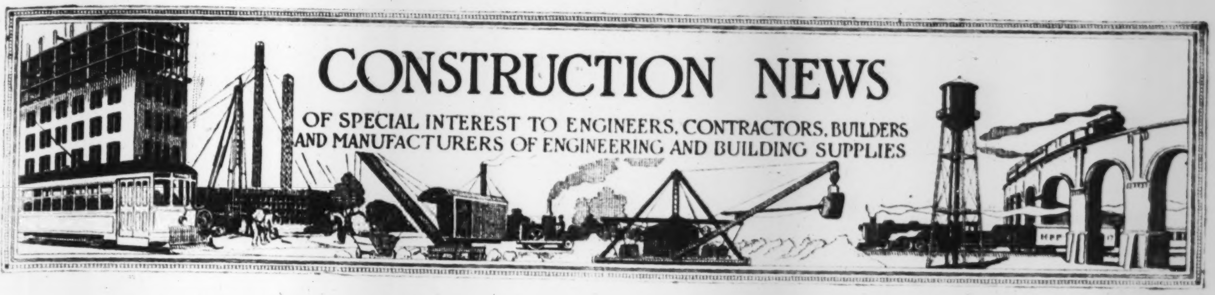

CONSTRUCTION NEWS

OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

PROPOSALS

For proposals Advertised see the pages immediately following the "Construction News" Section.

WATERWORKS

Bids Close		See Eng. News-Record
June 25	New York, N. Y.	June 17
June 26	Dansville, N. Y.	June 10
June 28	Ironwood, Mich.	June 17
June 28	Colfax, Wis.	June 24
June 29	Ford City, Pa.	June 24
June 29	Buffalo, N. Y.	June 3
June 30	Seymour, Ind. Adv. June 24.	June 24
June 30	El Reno, Okla.	June 24
June 30	Central Islip, N. Y. Adv. June 24.	June 24
July 1	Madill, Okla.	June 10
July 1	Glendale, Cal.	June 24
July 7	Dearborn, Mich. Adv. June 24.	June 24
July 9	Collinsville, Ill. Adv. June 10 to 24.	June 10
July 23	Akron, O. Adv. June 24.	June 24

SEWERS

Bids Close		See Eng. News-Record
June 28	Brillion, Wis.	June 10
June 29	St. Louis, Mo.	June 17
July 1	Milwaukee, Wis.	June 3
July 1	Waterloo, Wis.	June 24
July 1	St. George, S. I., N. Y.	June 10
July 1	South Beach, S. I., N. Y.	June 17
July 1	Le Roy, Minn.	June 17
July 1	Elmore, Minn.	June 17
July 6	Coatesville, Pa. Adv. June 24.	June 24
July 6	Boonton, N. J. Adv. June 17 and 24.	June 17
July 6	Danville, Ky. Adv. June 24.	June 24
July 9	Worthington, O.	June 24
July 12	Milford, Mich.	June 24
July 12	Milford, Mich.	June 24
July 19	Dallas, Ore	May 27

BRIDGES

Bids Close		See Eng. News-Record
June 28	Beloit, Wis.	June 24
June 30	Rhode Island. Adv. June 24.	June 24
July 1	Eatonville, Wash.	June 24
July 1	Perry Ga.	June 17
July 2	Lyons, N. Y. Adv. June 24.	June 24
July 2	Abiquin, N. M.	June 24
July 3	Williamsport, Pa.	June 24
July 3	Granville N. Y. Adv. June 17 and 24.	June 17
July 5	Greenfield, Ind.	June 17
July 6	Elk Point, S. D.	June 17
July 6	Yorba Linda, Cal.	June 17
July 6	Meridian, Miss.	June 24
July 6	Manchester, N. H.	June 17
July 6	San Jose, Cal.	June 24
July 7	Red Bank, N. J. Adv. June 17 and 24.	June 17
July 12	Chadds Ford, Pa. Adv. June 24.	June 24
July 12	Nevada Adv. June 24.	June 24

STREETS AND ROADS

Bids Close		See Eng. News-Record
June 26	Dansville, N. Y.	June 10
June 28	Savannah, Ga.	May 13
June 28	Reno, Nev.	June 3
June 28	Newton, N. J.	June 17
June 28	Tombstone, Ariz.	June 10
June 28	Florence, Ariz.	June 10
June 28	New Jersey	June 10
June 28	Minneapolis, Minn.	June 17
June 28	Tarkio, Mo. Adv. June 24.	June 24
June 28	St. George, S. I., N. Y.	June 24
June 28	Monticello, Mo.	June 24
June 28	Milwaukee, Wis.	June 24
June 28	Sirdar, B. C.	June 24
June 29	St. George, S. I., N. Y.	June 24
June 29	Jersey City, N. J.	June 24
June 29	Mayville, Wis.	June 24
June 29	Roselle Park, N. J.	June 17
June 29	Wallingford, Conn.	June 17
June 29	St. Louis, Mo.	June 10
June 30	San Diego, Cal.	June 24
June 30	Freehold, N. J Adv. June 17 and 24.	June 10
June 30	Rhode Island Adv. June 10 to 24.	June 17
June 30	San Angelo, Tex.	June 24
June 30	Payson, Utah	June 24
June 30	Brooklyn, N. Y.	June 24
July 1	St. Lambert, Que.	June 24
July 1	Caledonia, Minn.	June 24
July 1	Ft. Worth, Tex. Adv. June 17 and 24.	June 17
July 1	Vermont Adv. June 1 7and 24.	June 24
July 1	San Diego, Cal.	June 24
July 1	Canadian, Tex.	June 24
July 2	New Mexico	June 24
July 2	Girard, Kan.	June 24
July 2	Oak Harbor, O.	June 24
July 2	New York Adv. June 24.	June 24
July 2	Winchester, Ky. Adv. June 24.	June 24
July 3	Tucson, Ariz.	June 17
July 3	Richmond, Tex.	June 24
July 3	St. Davids, Que.	June 24
July 5	New Madrid, Mo. Adv. June 17 and 24.	June 17
July 6	Wilmington, Del. Adv. June 17 and 24.	June 17
July 6	Amsterdam, N. Y. Adv. June 24.	June 24
July 6	Santa Barbara, Cal.	June 17
July 6	Visalia, Cal.	June 17
July 6	Charleston, S. C. Adv. June 1 7and 24.	June 24
July 6	Baltimore, Md. Adv. June 24.	June 24
July 6	Athens, Ga.	June 24
July 6	Dallas, Ore.	May 27
July 6	Parnassus, Pa.	June 24
July 6	Baltimore, Md.	June 24
July 6	New Mexico	June 24
July 7	Springfield, Ill.	June 24
July 7	Rhode Island Adv. June 24.	June 24
July 7	Jersey City, N. J.	June 24
July 7	Hood River, Ore.	June 24
July 7	Breckenridge, Minn.	June 24
July 7	Hudson Falls, N. Y. Adv. June 24.	June 24
July 7	Baltimore, Md. Adv. June 24.	June 24
July 7	Wisconsin	June 24
July 8	Washington, Kan.	June 24
July 9	Akron, O. Adv. June 24.	June 24
July 9	Kansas City, Kan.	June 24
July 10	Quebec	June 24
July 10	New Mexico	June 24
July 12	Fergus Falls, Minn.	June 17
July 12	Madison, W. Va.	June 17
July 12	Auburn, N. Y. Adv. June 24.	June 24
July 12	Troy, Kan.	June 24
July 12	Baltimore, Md Adv. June 24.	June 24
July 13	Ft. Scott, Kan.	June 24
July 14	Baltimore, Md.	June24
July 14	Tavares, Fla. Adv. June 17 and 24.	June 10
July 14	Mora, Minn.	June 24
July 15	Flemington, N. J. Adv. June 24.	June 24
July 16	New Mexico	June 24
July 17	New Mexico	June 24
July 23	Garden City, Kan.	June 24

RAILWAYS

Bids Close		See Eng. News-Record
July 2	British Columbia	June 17

EXCAVATION AND DREDGING

Bids Close		See Eng. News-Record
July 3	Madisonville, Ky.	May 27
July 6	Paducah, Ky. Adv. June 24.	June 24
July 7	Montezuma, Ia. Adv. June 24.	June 24
July 17	Belzoni Miss.	June 2
June 28	Waseca, Minn.	June 2

INDUSTRIAL WORKS

Bids Close		See Eng. News-Record
June 28	Cleveland, O.	June 17
June 28	Port Washington, Wis.	June 24
June 29	Comstock, N. Y.	June 17
June 29	Milwaukee, Wis.	June 24
June 30	Cambridge, Mass.	May 27
Sept. 1	Hutchinson, Kan.	Feb 19

BUILDINGS

Bids Close		See Eng. News-Record
June 28	Youngstown, O.	June 10
June 28	Hiawatha, Kan.	June 24
June 28	Flint, Mich.	June 24
June 28	Wynne, Ark.	June 17
June 28	Trenton, N. J. Adv. June 17 and 24.	June 17
June 29	Duluth, Minn.	June 10
June 29	Belchertown, Mass.	June 24
June 30	New York, N. Y.	June 10
June 30	Cheektowaga (Forks P. O.), N. Y.	June 1
June 30	West New York, N. J.	June 24
June 30	Mapleton, Ia.	June 24
June 30	Parsons, Kan.	June 24
July 1	Chisholm, Minn.	May 13
July 1	McCallsburg, Ia.	June 24
July 5	Camden Point, Mo.	June 24
July 5	Killduff, Ia.	June 24
July 5	Cambria, Ia.	June 17
July 7	Gallipolis, O.	June 17
July 7	Warren, O.	June 24
July 15	Jonesboro, Ark.	May 27
July 15	Coleraine, Minn.	June 10
July 16	Fullerton, Cal. Adv. June 10 to 24.	June 17
July 25	Liberty Center, Ia.	June 24
Aug. 2	Salina, Kan.	June 17
Aug. 16	Sioux City, Ia.	June 17

FEDERAL GOVERNMENT WORK

Bids Close		See Eng. News-Record
June 26	Laundry Machinery — Tacoma, Park (Wash. P. O.), D. C. Adv. June 17 and 24.	June 17
June 26	Warehouses—Ft. Sam Houston, Tex. Adv. June 17 and 24.	June 17
June 26	Materials and Supplies — Tacoma Park, D. C. Adv. June 1 7and 24.	June 24
June 26	Roads, Walks, Drainage and Grading — Tacoma Park (Wash P. O.), D. C. Adv. June 10 to 24.	June 10
June 28	Dredge, etc.—Wilmington, N. C. Adv. May 27 to June 24.	May 27
June 28	Station Building and Accessories — Long Beach, N. Y. Adv. June 3 to 24.	June 17
June 30	Dredging—Norfolk, Va.	June 10
June 30	Tug Boat—Wash., D. C.	June 3
June 30	Cold Storage Insulation—Spec. 4199 — San Diego, Cal.	June 17
June 30	Refrigerating Plant Equipment — Spec. 4193 — San Diego, Cal.	Jnue 24
July 1	Dredging — New York, N. Y. Adv. June 17 and 24.	June 3
July 1	Manila Rope — Memphis, Tenn.	June 17
July 2	Bulkhead, etc. — Norfolk, Va. Adv. June 17 and 24.	June 10
July 3	Structural Steel, Castings, etc.—Louisville, Ky	June 10
July 7	Incinerator—Spec. 4137—Quantico, Va.	June 24
July 7	Sewers and Watermains — Spec. 4178 — Hampton Roads, Va.	June 24
July 7	Storehouse — Spec. 4157 San Diego, Cal.	June 24
July 8	Charcoal Iron Boiler Tubes Charleston, S. C.	June 3

Bids Close		See Eng. News-Record
July 8	Steel Dump Scow—Louisville, Ky. Adv. June 10 to 24.	June 10
July 8	Rubber Hose — Memphis, Tenn. Adv. June 10 to 24.	June 17
July 9	Brick Set, etc.—Athens, O.	June 24
July 12	Additions and Repairs to Conduit, etc.—Zanesville, O.	June 24
July 14	Seagoing Hopper Dredge Sabine—Galveston, Tex. Adv. June 17 and 24.	June 17
July 15	Galvanized Wire, Wire Strand, Staples and Wire Rope Clips — Memphis, Tenn. Adv. June 17 and 24.	June 17
July 15	Dredging — Wilmington, Del. Adv. June 17 and 24.	June 17
July 15	Gate and Valve Operating Machinery — Pittsburgh, Pa. Adv. June 24.	June 24
July 24	Dredging — New York, N. Y. Adv. June 24.	June 24

MISCELLANEOUS

June 28	Lumber and Piling—Kaufman, Tex.	June 10
June 28	Breakwater—Friars Head, N. S.	June 21
June 28	Freight Shed and Pier—New York, N. Y.	June 17
June 29	Wood Block — Cincinnati, O.	June 24
June 30	Pumps—Nashville, Tenn.	June 3
July 2	Pumps—Cleveland, O.	June 24
July 2	Coal Crusher—Cleveland, O.	June 24
July 6	Pipe—Terra Bella, Cal.	June 17
July 6	Pier—Bayfield, Ont.	June 24
July 6	Wharf—Ste Famille, Que.	June 24
July 8	Laundry Machinery—Randalls Island, N. Y.	June 10
July 12	Tractors, Elevating Graders and Dump Wagon—Wadena, Minn.	June 17
July 20	Terminal Freighthouse — New York, N. Y.	June 24

Where name of official is not given inquiries should be addressed to City Clerk, County Clerk or corresponding official.

Waterworks

PROPOSED WORK

N. J., Trenton—City Comn. soon receives bids installing 25,000,000 gal. pump and 1,000 hp. steam turbine generator, for waterworks. About $75,000. J. R. Fell, Trenton, engr.

Minn., Albert Lea—City soon lets contract building waterworks system, to include 2 motor-driven centrifugal pumps with automatic control, 2 air compressors and 2 motors with belt drive. 1 horizontal driven double suction centrifugal pump, capacity 800 gal. per minute against 50 ft. total head direct connected to one 14 brake h.p. steam turbine. R. G. Lindgren, Albert Lea, engr.

Minn., Buffalo—Village rejected bids received June 4, building waterworks system and deep well. About $60,000. Work may be readvertised. Noted May 27.

Kan., Peru—City having plans prepared by Archer & Stevens, engrs., 609 New Engineering Bldg., Kansas City, building waterworks system. About $50,000.

Kan., Portis—City having plans prepared by Archer & Stevens, engrs., 609 New Engineering Bldg., Kansas City, constructing new well, waterworks and distributing system. About $32,000.

Mo., Fayette — City having plans prepared by Johnson & Benham, engrs., Firestone Bldg., Kansas City, Mo., for earth filled dam and pipe line. Cost between $30,000 and $35,000. T. R. Moore, clk.

Ore., La Grande—City having plans prepared by L. C. Kelsey, consult. engr., Portland, for gravity water supply system. Cost between $500,000 and $1,000,000, depending upon source of supply recommended.

BIDS DESIRED

N. Y., Central Islip—Until June 30, by State Hospital Comn., Capitol, Albany, building artesian well, at State Hospital, here. L. F. Pilcher, state archt.; advertised in this issue.

Pa., Ford City—Until June 29, by Clerk of Council building circular concrete reservoir and 12 in. rising main leading to same, also power house addition. Douglas & McKnight, Columbia Bank Bldg., Pittsburgh, engrs.

O., Akron—Until July 23, (change of date) by E. A. Zeisloft, dir. Pub. Serv. constructing and equipping addition to water purification plant. (Contracts 170 and 205). About $10,000 and $5,000 respectively; advertised in this issue.

O., Seymour—Until June 30, by Seymour Water Co. building rein.-con. sedimentation reservoir. C. H. Hurd, 1405 Merchants Bank Bldg., Indianapolis, Ind., consult. engr.; advertised in this issue.

Mich., Dearborn—Until July 7, by F. C Beamer, village clk., building water main extensions, involving 7,629 ft. 6-18 in. c.i. pipe; advertised in this issue.

Wis., Colfax—Until June 28, by T. Runnung, village clk., furnishing labor and material for building waterworks and sewerage system, involving 4,388 ft. watermains and 1,068 ft. sewer pipe.

Okla. El Reno—Until June 30, by city clerk improving waterworks system involving two high-duty steam pumping engines of 2,000,000 gal. daily capacity; 1,000,000 gal. reservoir. Burns & McDonnell Interstate Bldg., Kansas City, Mo. engrs.

Cal., Glendale—Until July 1, by City clk., furnishing and laying 6,700 ft. 16 in. riveted steel pipe, 10 gate valves and 5 fire hydrants.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

O., Akron—City received bids June 18, laying 4,650 ft. 48 in. Class "B" c.i. pipe and 9,000 cu.yd earth excav., from G. A. Gesna Co., Toledo, $46,006; Dodge Constr. Co., Rochester, N. Y., $60,288; A. W. Hinaman and R. D. Salisbury, Akron, $61,782. Noted June 10.

★O., Akron—City let contract building waterworks system, involving 19,800 cu.yd. earth and 200 cu.yd. rock excav., 25 cu.yd. concrete masonry and 29,650 ft. 4-20 in. c.i. pipe, to Gangl Constr. Co., 737 2nd Natl. Bank Bldg., $41,996.

★Mich., Detroit—City will lay water mains in Lakewood Blvd., Lenox, Montclair, Radcliffe, Kingsley, Belleterre, Fleming and Lumpkin Aves., etc., involving 10,000 ft. 6-8 in. c.i. pipe. About $30,000. Work will be done by day labor.

★Mich., Grosse Pointe Park (Detroit P. O.)—City let contract furnishing labor and material for trenching and laying 8,000 ft. 6 in. c.i. water pipe in Beaconsfield and Queen Aves., to include valves, hydrants and specials, to T. Iglehart, 209 South La Salle St., Chicago, Ill. About $25,000. Noted May 13.

Ia., Cherokee—State Bd. Control, Des Moines, receives bids about July 1, improving waterworks system at State Hospital, here. About $70,000. W. E. Buell, Davidson Bldg., Sioux City, engr. Noted Jan 15.

Tex., Cisco—City received bids building dam for waterworks system (a) earth, (b) rock fill, (c) hollow concrete, (d) solid concrete, from W. A. Wogan, Cisco, (a) $1,075,465, (b) $1,015,685; F. H. Harris, Ranger, (a) $1,082,952; H. T. Freistedt, Houston, (a) $831,534, (c) $914,050, (d) $1,154,148. Noted May 6.

Sewers

PROPSED WORK

N. Y., Greycourt—Dept. of Correction, Municipal Bldg., New York City, rejected bids building sewage disposal plant including 2,050 ft. absorption ditches and outlet pipe, here. About $50,000. Work will be readvertised.

N. Y., North Tonawanda—Bd. Pub. Wks. commissioned Chester & Fleming, consult. engrs., Union Bank Bldg., Pittsburgh, Pa., to submit report for sewerage system and sewage disposal plant.

N. J., Newark — Dept. Streets & Pub. Impvts. receives bids about July 1, building 4,000 ft. concrete sewers in Maple and Hansbury Aves. About $25,000. M. R. Sherrerd, city engr.

Mich., Detroit—City soon lets contract trenching and laying vitr. crock Lateral Sewer 3,223, involving 894 ft. 12-13 in. pipe, 3,292, 11,529 ft. 12-33 in. pipe, 3,293, 13,576 ft. 12-36 in. pipe, 3,294, 4,581 ft. 10-12 in. pipe. C. W. Hubbell, city engr.

Mich., Detroit—City rejected bids June 11, building 2,587 ft. sewer in Linwood Ave. from Fenkell to Puritan Aves., Sect. 4, involving 2 ft. 9 in.-5 ft. 3 in. cylinder, concrete, brick, vitr. or concrete segmental block pipe, etc. Work will be readvertised.

Mich., Detroit — City soon lets contract furnishing labor and material building uncompleted portion of former contract sewers in Mack Ave. from Balfour to Bedford Aves., involving 1,755 ft. 5 ft. 6 in. brick, concrete, vitr. segmental block or rein.-con. pipe, etc. About $45,000. C. W. Hubbell, city engr.

Wis., Kilbourn—City having plans prepared by W. G. Kirchoffer, engr., 31 Vroman Blk., Madison, for 3,000 ft. 2½ x 7 ft. rock tunneling in connection with sewerage system.

Idaho, Jerome—City having plans prepared by L. C. Kelsey, consult. engr., Nampa, for sewerage system, here. About $150,000.

Ont., Ottawa—Bd. Control soon receives bids building sewers in Woodstock Ave. from Fairmont to Melrose Aves., Melrose Ave. from Woodstock to Kenilworth Sts., Kenilworth St. from Melrose to Reid Aves., Reid Ave. from Kenilworth to Ruskin Sts. and Ruskin St. from Reid to Rosemount Aves., involving 12-24 in. tile pipe, cost $26,000; also paving Cobalt Ave. from Patterson to Clemow Aves., Tarvia macadam $5,000. A. F. Macallum, city engr.

BIDS DESIRED

Pa., Coatesville—Until July 6, by City Council, furnishing labor and material building sanitary and storm sewers. F. P. Pennegar, clk.; advertised in this issue.

Ky., Danville—Until July 6 (change of date) by Mayor, building 5,000 ft. small sewers, also 33,000 sq.yd. paving. S. F. Crecellus, Richmond, engr.; advertised in this issue. Noted June 17.

O., Worthington—Until July 9, by W. P. Vest, village clk., building sewers in various streets, involving 36,615 ft. 6-24 in. pipe. About $100,000. Jennings-Lawrence Co., Hartman Bldg., Columbus, engrs.

Mich., Milford—Until July 12, by C. W. Hubbell, city engr., furnishing labor and material for 1½ mi. sanitary sewerage system, involving 8-15 in. vitri. pipe. About $25,000. Noted March 4.

Wis., Colfax—See "Waterworks"

Wis., Waterloo—Until July 1 (change of date), by W. J. Higgins, village clk., building sewers in various streets, involving 16,106 lin.ft. 8 in., 4,710 ft. 10 in. and 4,220 ft. 12 in. vitr. pipe, 72 manholes, septic tanks, etc. About $70,000. Parsons & Orbert, 627 M. & M. Bank Bldg., Milwaukee, engrs. Noted June 3.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

Mass., Brighton (Boston P. O.)—City of Boston received bids June 11, building sewer in Market St., here, from A. Cefalo, $23,214; J. Barletta, $23,348; F. Drinkwater, $37,278.

O., Cleveland—City received bids June 10, building sewers in Bosworth Rd., Bellaire to Dixon Rds., from Yahya Bros., 3539 Independence Rd., $2,019; Sprague & Burkhardt, 1211 Woodland Ave., $2,065; Chestnut Hill Drive, Mapleside Rd. to Park Blvd. from Stevens & McKeon, 4208 East 96th St., $7,633; E. Cesa, 2462 Baldwin Rd. $7,724; A. Marra, Illuminating Bldg., $7,759; St. Clair Ave., East 140th to East 152nd Sts., from D. Zulo, 10501 Hudson Ave., $56,716; River Constr. Co., 12109 Mayfield Rd. $58,787; Gallagher-Burk Constr. Co., 1339 Irene Ave., $60,685.

O., West Park—S. Hendrickson, clk., Town Hall, received bids building sewer in Nichols Ave. from West 150th to West 162nd Sts., involving 2,030 ft. 3-6 ft. concrete and 2,770 ft. 12-24 in. vitr. pipe, from A. Marra, Illuminating Bldg., $47,286; Randall & Cooper, 345 Superior Arcade, $50,652; Sprague & Burkhardt, 12,011 Woodland Ave., $50,935. Contractors all of Cleveland.

Mich., Detroit — City received bids June 11, building sewer in (a) Fenkell Ave. from Linwood to Parkside Aves. and east from Linwood to Wabash Aves., involving 4 ft. 6 in.-5 ft. cylinder, (b) 670 ft. Monica Ave., 2 ft. 4 in. x 3 ft. 6 in. brick, concrete, vitr. segment block or rein.-con. pipe, from R. D. Baker, Penobscot Bldg., (a) $80,995, (b) $11,400; Jaynes & Affled, 1208 Ford Bldg., (a) $87,990, (b) $11,775; J. A. Mercier, 216 Hammond Bldg., (a) $92,624; W. Blanck & Co., 330 Longfellow St., (b) $14,694.

★Tex., Farmersville—Farmersville Waterworks and Sewerage Co. let contract laying 4,000 ft. 6-12 in. vitr. pipe sewer lines and installing 2 disposal plants, to J. W. Crook, Paris, $43,857. Noted June 10.

Wash., Seattle—Bd. Pub. Wks. received bids June 12, building sewers and water mains on 40th Ave., N., et al., involving 3,500 cu.yd. clearing and grading, 2,620 cu.yd. sub grading, 1,275 lin.ft. 6 in. concrete

Sewers (Continued)

paving, 1,275 limit type A armored concrete curbing, 1,268 lin.ft. 10 in. pipe sewer, and 3,390 lin.ft. 12 in. c.i. pipe sewer, from V. Ramaglia & Co., 4823 38th Ave. N. E., $55,247, Agostino Bros., Seattle, $58,636; F. N. Badolato, Seattle, $61,155.

Bridges

PROPOSED WORK

Conn., Bridgeport — City plans to build 450 ft. steel bridge with concrete abutments over Cedar Creek from Howard Ave. to Barnum Dyke. J. A. McElroy, city engr.

Conn., Bridgeport—City plans to build steel bridge over Ash Creek on Brewster St. About $25,000. J. A. McElroy, city engr.

Conn., Norwich—City plans to build rein.-con. bridge over Yantic River on West Main St. About $25,000. Chandler & Palmer, Thayer Bldg., archts.

S. C., Sumter—J. R. Pennell, state highway engr., Columbia, receives bids in about 60 days, building 250 ft. steel bridge over Wateree River, at Gerners Ferry Rd. crossing, for Sumter Co., (Sumter), and Richland Co., (Columbia). About $200,000.

O., Akron—Summit Co. plans to build concrete and steel bridge over Ohio canal. on Kenmore Blvd. About $200,000. Proposition will be submitted to voters at August primaries. Watson Eng. Co., Hippodrome Bldg., Cleveland, engrs.

Wisconsin—State Highway Comn., Madison, had surveys and plans prepared for Perry Bridge, three 24 x 35 ft. deck girder spans, concrete abutments, Brickway, Jackson Co.; Nashonoc Bridge, three 24 x 45 ft. concrete deck girder spans, concrete abutments, Hamilton, La Cross Co., three 8 x 20 ft., two 20 x 20 ft. and one 6 x 6 ft. rein.-con. span bridges, one 8 x 18 ft. slab span and two 4 x 4 ft. box culverts, Lafayette Co.; one 20 x 24 ft. deck girder span, one 20 x 24 ft., rein.-con. slab span, one 10 x 20 ft. and two 20 x 20 ft. concrete slab span bridges, Sauk Co.

Idaho—State Highway Dept., Boise, rejected bids received June 5, building 429 ft. steel bridge (cantilever type) over Owsley Ferry, Federal Aid Project 8, Twin Falls and Gooding Counties. About $90,000. Noted May 27.

Utah, Beaver—See "Streets and Roads"

Utah, Riverdale—State and Union Pacific R.R. plans to build 400 ft. rein.-con. and steel bridge, 22 ft. wide, over Weber River and Union Pacific R.R. tracks, here. About $140,000. I. R. Browning, Salt Lake City, state rd. engr.

Wash., Millwood—Spokane Co. (Spokane) soon receives bids building 320 ft. steel or concrete bridge, involving 93 cu.yd. rein.-con. for flooring, 704 cu.yd. concrete for piers, 198 ton steel, 165 cu.yd. stone, 508 cu.yd. excav., etc. About $50,000.

Oregon—State Highway Comn., Portland, rejected bids received June 1, building bridge on Crooked River Highway near Prineville, Crook Co., to have two 120 ft. and two 40 ft. wood truss spans, involving 35 cu.yd. Class "A" and 520 cu.yd Class "B" concrete, 9,500 lb. reinforcing steel, 520 lin.ft. standard wooden trestle and 1,000 cu.yd. excav.

BIDS DESIRED

Rhode Island—Until June 30, by State Bd. Pub. Rds., State House, Providence, building bridges 20, 145 and 146, known as Wakefield Bridge, North Kingstown, Centerdale Sluiceway, North Providence and Centerdale Bridge, North Providence and Johnston; advertised in this issue.

N. Y., Lyons—Until July 2, by C. W. Barrick, town supt. highways, at office of V. A. Berns, clk., building rein.-con. arch bridge, consisting of two 50 ft. spans with pier, abutments and appurtenant structures; advertised in this issue.

Pa., Chadds Ford—Until July 12, by G. S. Dewees, controller Chester Co. (West Chester) and O. L. Davis, controller Delaware Co. (Media), at offices of Comrs. (Chester Co.) West Chester, building twin span rein.-con. arch bridge, over Brandywine Creek, here; advertised in this issue.

Pa., Johnstown—Cambria Steel Co. receiving bids building substructure and superstructure for North Dump Bridge 6, over Pennsylvania R.R. deep cut, 185 ft. long 18 ft. roadway and 4 ft. sidewalk steel, lined with vitr. brick set in fire clay on rein.-con. foundation.

Pa., Williamsport—Until July 3, by L. O. Bower, clk. Bd. Comrs. Lycoming Co., building Shoemaker and Upper Hughesville Bridges, over Muncy Creek, both 55 ft. long and 25 ft. wide, each to have 3 concrete and steel girder spans. About $30,000. M. C. Krause, 335 Pine St., engr.

Miss., Meridian—Until July 6, by Bd. Supervisors, Lauderdale Co., building bridges and culverts. About $50,000. G. F. Hand, clk.

Wis, Beloit—Until June 28, by Bd. Pub. Wks., building 249 ft. rein.-con. bridge, 66 ft. wide, on Central St. Klug & Smith, Mack Blk., Milwaukee, consult. engrs. Noted April 1.

New Mexico—See "Streets and Roads."

N. M., Abiquiu—Until July 2, by State Highway Dept., Capitol Bldg., Santa Fe, building Chama Bridge 12 mi. north of here, in Rio Arriba Co., involving 24,050 ft. wood for superstructure, 4,418 ft. wood for substructure and 1,032 lin.ft. wooden piling. L. A. Gillett, state highway engr.

Nevada—Until July 12, by C. C. Cottrell, state highway engr., Carson City, building one 126 ft. steel pratt truss highway span on concrete abutments, over Humboldt River in Eureka Co.; advertised in this issue.

Wash., Eatonville—Until July 1, by Comrs. Pierce Co., (Tacoma), building 160 ft. bridge over Big Machell River, here, to have two 80 ft. steel spans, 18 ft. concrete or timber roadway on concrete abutments, etc. E. A. White, Seattle, engr.

Cal., San Jose — Until July 6, by Bd. Supervs. Santa Clara Co., building 4 span rein.-con. bridge, on Congress Spring Rd. Cost to exceed $25,000. H. A. Pfister, clk.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

N. Y., New York—Dept. Plants & Structures, Municipal Bldg., received lowest 3 bids, June 15, building Eastchester Bridge, over Eastchester Creek, Bronx Boro., from Lupfer & Remnick, Ellicott Sq., Buffalo, $508,871; P. T. Cox, 150 Nassau St., $512,315; Rogers & Haggerty, $537,100.

O., Columbus—Comrs. Franklin Co. received bids June 7 building 833 ft. concrete bridge 30 ft. wide, with two 6 ft. sidewalks, over Scioto River, on Greenlawn Ave., from I. E. Smith, Main Street Bridge, Richmond, Ind., cost, $436,987; Fritz, Roomee & Cooke Co., Columbus, $444,639. Noted May 20.

★Montana—See "Streets and Roads."

★Ariz., Florence—Pinal Co. let contract building concrete bridge, culverts, headwalls and retaining walls on 5 mi. section of Ray-Kelvin Rd., involving 698 cu.yd. concrete, 18,949 lb. reinforcing steel, 10,500 lb. steel rails, 870 cu.yd. cement rubble masonry and 616 ft. 18-48 in. metal pipe, etc. to R. C. Sheedy Constr. Co., 1493 East 42nd St., Los Angeles, $27,559. Noted May 13.

★Oregon—See "Streets and Roads"

★Ont., Ottawa—Carleton Co. let contract building 2 steel bridges, 60 and 80 ft. long, with 20 ft. roadway, on concrete abutments, 1 over Castor River, to C. O. Wood, Union Bank Bldg., $13,360 and 1 over Carp River, at Kinburn, to Ontario Bridge Co., Toronto Office Bldg., Toronto, $16,000.

Streets and Roads

PROPOSED WORK

Mass., Marlboro — Town appropriated $60,000 to pave and improve various streets. Private plans.

N. J., Newark — Bd. Freeholders Essex Co. plans to repair roads in Belleville and Nutley. About $350,000. F. J. Reimer, co. engr.

N. J., Newark—City plans to pave Scotland, High and Washington Sts. About $226,000. F. J. Reimer, co. engr.

N. J., Newark—Essex Co. plans to resurafce Mt. Pleasant Ave., Livingston and West Orange, also Chancellor Ave. from Elizabeth Ave., Newark, through Irvington to Springfield Ave., South Orange, bituminous macadam. About $104,000 and $500,000 respectively. F. J. Reimer, co. engr.

N. J., South Orange—City plans to resurface South Orange Ave., bituminous macadam. About $36,000. F. J. Reimer, co. engr.

Pennsylvania — State Highway Dept., Harrisburg, received no bids June 15, paving 15,550 ft. Route 246, McCandless and Pine Twps., Allegheny Co.; 20,996 ft. Route 117, Dunbar Twp., also 15,886 ft. Route 366, Bullskin and Connellsville Twps., Fayette Co.; 22,287 ft. Applications 154 and 1,096, Farmington and Pine Grove Twps., Warren Co.; 16,137 ft. Route 181, Sect. 2, Somerset and Nottingham Twps., Washington Co. Noted May 20.

Pennsylvania — State Highway Dept., Harrisburg, rejected bid received June 16, paving 15,323 ft. Route 288, Perry Twp., Fayette Co. Noted May 20.

Pennsylvania — State Highway Dept., Harrisburg, received no bids June 16, paving 18,514 ft. Route 89, Sect. 1, East Mead Twp., Crawford Co.; 15,080 ft. Route 113, Sect. 2, North and South Union and Menallen Twps., Fayette Co.; 25,030 ft. Routes 223 and 314, East Wheatfield Twp., Indiana Co.; 10,688 ft. Route 141, Orwigsburg Boro., Schuylkill Co.; 3,419 ft. Route 89, Sect. 1, Plum Twp., Venango Co.; 22,845 ft. Route 181, Sect. 1, North and South Strabane Twps., Washington Co. Noted May 20.

Pa., Scranton—City passed ordinance and soon receives bids grading, paving and curbing Olyphant Ave. from Boulevard Ave. to East Parker St., sheet asphalt and stone blocks on concrete base. About $28,904. W. A. Schunk, city engr.

W. Va., Madison—Boone Co. voted $146,000 bonds to grade 10 mi. road from here to Clothier. J. P. Blunder, co. engr. Noted June 3.

N. C., Reidsville—Rockingham Co. plans to top soil 6 mi. Greensboro-Danville Rd., 16 ft. wide. About $30,000.

O., Cincinnati—City soon receives bids paving 3,000 ft. Freeman Ave. from Kenner to Central Sts., 36 ft. wide, granite block, cost $105,000; 3,000 ft. Eastern Ave. from Ferry to Lavender Sts., 40 ft. wide, granite block, $300,000; 4,600 ft. Central Ave. from Liberty to Colerain Sts., 36 and 40 ft. wide, granite block or wood block, $135,000; grading, curbing, draining, paving and laying 6 in. water mains in 1 mi. Hamilton Ave. from Belmont to North Bend Rd., 40 ft. wide, granite block, $225,000.

O., St. Clairsville—Belmont Co. plans to pave 2 mi. Colerain Pike, 16 ft. wide, concrete. About $72,000. L. Darrah, co. engr.

O., Fremont—City passed ordinance to pave Buchanan, Howland and Pine Sts. About $7.47 per ft.

Mich., Detroit—City soon receives bids furnishing labor and material grading, shaping and paving Lycaste Ave. from point 100 ft. south of Detroit Terminal R.R. to southerly terminus, 26 ft. wide, granite block on 8 in. concrete foundation, Amherst, Medina or Berea curbstone, cost $62,029; Alter Rd. from Lakeside Drive to Jefferson Ave. and Lafayette Ave. from Green to Springwells Aves., 26 ft. wide, sheet asphalt on 8 in. concrete foundation, Amherst, Medina or Berea curbstone, $116,111 and $35,770 respectively; Coplin Ave. from Kercheval Ave. to point 712 ft. north of Charlevoix Ave. and Joy Rd. from Linwood to Grand River Aves., 26 ft. wide, sheet asphalt on 8 in. concrete base, $53,710 and $156,150 respectively; alley between 2d and Cass Aves. and Stimson and Brainard Sts., also alley between 18th, 17th, Howard and Porter Sts., 20 ft. wide, new 1 course concrete, 2 x 6 in. retaining plank, Medina headers, $8,010 and $6,090 respectively; east and west alley between Lawton, Linwood, Pingree and Blaine Aves., 20 ft. wide, and east and west alley between Fisher, Crane, Mack and Sylvester Aves., 18 ft. wide, new 1 course concrete, $4,680 and $1,940 respectively. C. W. Hubbell, city engr.

Wisconsin — State Highway Comn., Div. Office 2, Stephenson Bldg., Milwaukee, rejected bids June 14, grading and paving Milwaukee-Fond du Lac Rd., Federal Aid Project 160, Menomonee Falls, also West Bend-Milwaukee Rd., Federal Aid Project 159, Washington Co. Work will probably be readvertised. Noted June 3.

Ia., Orange City—City plans to build 3 mi. road, involving 40,000 sq.yd. bitulithic pavement. About $100,000. K. C. Gaynor Co., 800 Guardian Life Bldg., St. Paul, Minn., engrs.

Minn., Alexandria — V. Thomas, aud. Douglas Co., rejected bids received June 1, building 7 mi. Federal Aid Project 131, State Rd. 1, 24 ft. wide. About $45,000. Work will be readvertised. Noted May 20.

Minn., Alexandria — V. Thomas, aud. Douglas Co., rejected bids received June 4, building 1.75 mi. State Rd. 5, County Job 2002, 24 ft. wide. About $25,000. Work will be readvertised. A. Webster, Alexandria, engr. Noted May 20.

Minn., Brainerd—Crow Wing Co. received no bids June 5, grading and graveling 12.5 mi. State Rd. 1, Div. "A." Job 1908. About $60,000. C. L. Motl, Brainerd, engr. Noted April 20.

Minn., Little Falls—Auditor Morrison Co. rejected bids received June 1; paving 10 mi. Federal Aid Project 154, 18 ft. wide, concrete. About $350,000. Work will be readvertised. J. E. Viner, Little Falls, engr. Noted May 20.

Mo., Paris—Monroe Co. plans to improve 5 mi. Paris-Louisiana Rd., involving 20,000 cu.yd. earth excav., 26,400 sq.yd. gravel surfacing and 4 rein.-con. culverts, cost $26,312; 7½ mi. Paris-Monroe Rd., 37,080 cu.yd. earth excav., 39,600 sq.yd. gravel surfacing, 8 rein.-con. culverts, and repair old bridge, $66,374.

Streets and Roads (Continued)

Ark., Harrisburg — Poinsett Co. soon receives bids grading and building culverts on 11.4 mi. and surfacing with gravel 10.7 mi. Ozark Trail Rd., 24 and 14 ft. wide respectively. Work involves 140,000 cu.yd. earth embankment, 21 acres clearing and grubbing, 400 lin.ft. concrete culverts and 88,000 sq.yd. gravel. Morgan Eng. Co., Goodwyn Institute Bldg., Memphis, Tenn., engrs.

Tex., Abilene—Taylor Co. having plans prepared grading and building rein.-con. and steel bridges on 11.36 mi. highway from Coleman Co. line to intersection of Highway 30, 24 ft. wide, involving 6.5 acres clearing and grubbing, 602.4 cu.yd Class "A" and 508.4 cu.yd. Class "B" concrete, 44,026 lb. reinforcing steel, 57,700 lb. structural steel, 45,000 cu.yd earth and 200 cu.yd rock excav., etc. About $66,140. R. W. McCargo, resident engr.

Tex., Bastrop—Bagtorp Co., having plans prepared grading, surfacing and draining 8.814 mi. Highway 20-A, through Rd. Dist. 3, 14 ft. 8 in. wide, involving 5 acre clearing and grubbing, 21,120 cu.yd. embankment borrow, 16,080 cu.yd. gravel surfacing, 15,992 lb. reinforcing steel, 214.9 cu.yd. Class "A" and 185 cu.yd. Class "B" concrete, 11,495 cu.yd. earth excav., etc. About $68,993. A. F. Mitchell, Cameron, engr.

Tex., Canyon—Randall Co. having plans prepared paving and building rein.-con. culverts on 17.1 mi. Highway 33 from Canyon city to Deaf Smith Co. line, 24 ft. wide, involving 6,438 cu.yd. borrow and 85,759 lin.ft. grading. About $28,192. Nagle, Witt & Rollins, Amarillo, engrs.

Tex., Cleburne—Johnson Co. having plans prepared for grading, graveling and draining 13 mi. Highway 2-A from Burleson to Alvarado, 16 ft. wide, involving 40 acres clearing and grubbing, 1,280 cu.yd. 1:2:4 and 70 cu.yd. 1:2:3 concrete, 14,600 lb. reinforcing steel, 27,112 cu.yd gravel, 13,560 cu.yd. granite gravel, 68,600 cu.yd unclassified and 650 cu.yd. rock excav., etc. About $276,159. R. O. Whiteaker, Cleburne, engr.

Tex., Greenville—Hunt Co. having plans prepared grading, surfacing and draining 10.79 mi. Highway 1 from here to Commerce, via Neyland, 16 ft. wide, involving 8 acres clearing and grubbing, 556.3 cu.yd. Class "A" and 629.7 cu.yd. Class "B" concrete, 28,849 cu.yd. stone, 71,733 lb. reinforcing and 126,426 lb. structural steel, 75,520 cu.yd. unclassified excav., 95,691 gal. bituminous material, etc. About $298,430. A. D. Duck, Greenville, engr.

Tex., McKinney—Collin Co. election June 28, to vote on $60,000 bonds to build roads. J. B. Crockett, McKinney, co. engr.

Tex., Marshall—Harrison Co. having plans prepared grading, surfacing and draining 8.7 mi. Highway 8 from Marion Co. south to here, 12 ft. wide, involving 5 acres clearing and grubbing, 30,000 cu.yd. borrow, 15,000 cu.yd. earth and 200 cu.yd. loose rock excav., 3.33 mi. scarifying, 275 cu.yd. Class "A", 75 cu.yd. Class "B" and 50 cu.yd. Class "C" excav., 19,900 cu.yd. gravel, 22,000 lb. reinforcing steel, etc. About $92,895. G. A. Duven, Marshall, engr.

Tex., Sinton—San Patricio Co. having plans prepared grading, surfacing and draining 15.517 mi. Highway 9, through Rd. Dist. 1, 16 ft. wide, involving 14.145 mi. machine grading, 9,303 cu.yd. earth borrow, 15,629 cu.yd. gravel and 27,389 cu.yd. shell surfacing, 2,768 lb. reinforcing steel, 24 cu.yd. Class "A" and 12 cu.yd. Class "B" concrete, 3,202 cu.yd. earth excav., etc. About $157,844. A. C. Pancoast, Beeville, engr.

Tex., Sinton — San Patricio Co. having plans prepared grading, draining, surfacing with gravel and shell and building steel bridges on 12.04 mi. Highway 9, Rd. Dist. 5, 16 ft. wide, involving 7 acres clearing and grubbing, 560.8 cu.yd. Class "A" and 174.6 cu.yd. Class "B" concrete, 12,982 cu.yd gravel, 22,760 cu.yd. shell, 1,920 lin.ft. piling, 94,800 lb. structural steel, 38,368 lb. reinforcing steel, 32,703 cu.yd. earth excav., etc. About $191,549. A. C. Pancoast, Beeville, engr.

New Mexico — State Highway Dept., Santa Fe, received no bids June 2, building 10.859 mi. New Mexico Federal Aid Project 13-A, between Rio Puerco and Armijo, Valencia Co. Informal proposals will be considered. L. A. Gillett, state highway engr.

Idaho, Caldwell—City plans to pave various streets. About $200,000. L. C. Kelsey, Nampa, consult. engr.

Utah, Beaver—Beaver Co. voted $125,000 bonds to build roads and bridges.

Utah, Payson—City plans to pave Depot St., 40 ft. wide, bitulithic topping on concrete base. About $59,000. R. Manson, city clk. C. A. Swan, Provo, engr.

Utah, Provo—City plans to pave ½ mi. road, 40 ft. wide, bituminous macadam. About $52,000. C. A. Swan, city engr.

Utah, Salt Lake City—City plans to improve 7th and 8th East Sts., involving 3,600 lin.ft. concrete curbing and guttering, cost $40,000; pave 2.2 mi. North Temple St., also .35 mi. Stratford Ave., both 40 ft. wide with 5 in. bituminous on 5 in. concrete base, $85,000 and $25,800 respectively. S. Q. Cannon, city engr.

Wash., Arlington—City plans to build sidewalks and cross walks on main business streets, involving 38,910 lin.ft. 5 in. concrete sidewalk and cross walks, 7 ft. wide. About $67,260. F. Tegmeir, 1332 Grand St., Everett, engr.

Oregon—State Highway Comn., Portland, rejected bids received June 1, surfacing 9.35 mi. Elgin-Minam Sect., La Grande-Enterprise Highway, Union Co., involving 19,500 cu.yd. broken stone and 11,000 yd.-miles payhaul.

Cal., Los Angeles—Bd. Supervs. Los Angeles Co. receives bids latter part of July or beginning of August, improving 2.07 mi. 7th Ave., Rd. Dist. 166, near Puente, involving plain and rein.-con. paving, concrete curbing and guttering, rein.-con. and corrugated iron culverting, etc. A. M. McPherrin, clk.

Cal., San Diego—Common Council rejected bids received June 1, paving Lytton and Voltaire Sts., Chatsworth and Catalina Blvds. Work will be readvertised. Noted April 1.

Cal., San Luis Obispo—City rejected bids grading and paving Higuera, Chorro and Monterey Sts., asphaltic surface. About $37,618. Work will be readvertised. W. B. Burch, San Luis Obispo, engr.

Quebec—Dept. of Rds., Quebec, soon receives bids building road from Magdalen River to St. Anne de Monts, Gaspe Co., waterbound macadam. About $840,000.

Ont., Ottawa—See "Sewers"

Ont., Toronto—City plans to grade 3 mi. Woodbine Ave. from Kingston Rd. to Gerrard St., also pave Walmer Rd. from Bridgman to Davenport Rds., involving 3,200 sq.yd. vitr. brick and 300,000 cu.yd earth excav. About $325,000. R. C. Harris, city engr.

BIDS DESIRED

Vermont—Until July 1, by State Highway Comn., Montpelier, building 4.03 mi. road in South Burlington and Shelburne, bituminous macadam, 4.07 mi. New Haven, Waltham and Ferrisburg, 0.71 mi. St. Albans, 0.73 mi. Barnet, waterbound macadam; 13.57 mi. Dorset, Mt. Tabor and Danby, 5.6 mi. Dumerston and 1.26 mi. East Montpelier, gravel. S. B. Bates, comr.; advertised in this issue.

Rhode Island—Until July 7, by State Bd. Pub. Rds., State House, Providence, rebuilding 2 mi. road, from point 1,000 ft. south of Nanaquaket Bridge extending south on Sakonnet Point Rd., Tiverton Twp.; advertised in this issue.

New York—Until July 2, by F. S. Greene, state highway comr., Capitol, Albany, improving road in Albany, Columbia, Dutchess, Fulton, Greene, Lewis, Oneida, Rensselaer, Ulster and Warren Counties; advertised in this issue.

N. Y., Amsterdam—Until July 6, by Common Council, paving Lyons and Van Der Veer Sts., involving 5,200 sq.yd. rein.-con. and 1,100 lin.ft. concrete curbing. T. J. Hazlett, city clk.; advertised in this issue.

N. Y., Auburn—Until July 12, by J. P. Jackel, city mgr., paving Orchard St. from James to South Division Sts.; advertised in this issue.

N. Y., Brooklyn—Until June 30, by E. Riegelmann, boro. pres., regulating, recurbing and paving with permanent asphalt on 6 in concrete foundation, roadway of Benson Ave. from 16th to 17th Aves., 55th St. from 12th to New Utrecht Aves., regulating and paving with permanent asphalt on 6 in. concrete foundation, roadway of 65th St. from 14th to New Utrecht Aves., and East 15th St. from Ave. K to point about 286 ft. south, with preliminary bituminous macadam 6 in. thick, from point about 286 ft. south of Ave. K to Ave. L, regulating, grading, curbing and laying sidewalks on Carroll St. from Utica to Schenectady Aves. regulating, paving and repaving with permanent grade 1 granite pavement on 6 in. concrete foundation, roadway of Maspeth Ave. from Olive St. to Morgan Ave., also furnishing and delivering 7,300 cu.yd. 2½ in. broken trap rock and 2,700 cu.yd. trap rock screenings.

N. Y., Hudson Falls—Until July 7, by L. R. Lewis, village clk., paving John St., involving 3,800 sq.yd. concrete, etc.; advertised in this issue.

N. Y., St. George, S. I.—Until June 28, by C. D. Van Name, pres. Richmond Boro., repaving Richmond Rd. from Rockland Ave. to Amboy Rd., concrete. About $25,000.

N. Y., S. I., St. George—Until June 29, by C. D. Van Name, pres. Richmond Boro., repaving Rockland Ave. from point 1,100 ft. west of Manor Rd. to Richmond Rd., concrete.

N. J., Flemington—Until July 15, by Bd. Freeholders Hunterdon Co., building Lambertville-Ringoes Rd., Sections 1 and 2, Flemington-Ringoes Rd., Sect. 3, Whitehouse-Flemington Rd., Sections 4 and 5. Bids to be received in 2 groups, Group A comprising 1st and 2nd sections, Group B, 3rd, 4th and 5th sections. W. W. Foster, clk.; advertised in this issue.

N. J., Jersey City—Until June 29, by city, regulating and repaving with sheet asphalt on present stone and concrete foundation, roadway of Astor Pl. from Crescent to Summit Aves., Summit Ave. from Astor Pl. to Baldwin Ave., Baldwin Ave. from Summit Ave. to Prospect St. and Webster Ave. from Prospect St. to Paterson Plank Rd. About $500,000. F. Dolan, clk.

N. J., Jersey City—Until June 29, by City Comrs., improving Williams Ave. between Mallory Ave. and Bennett St., sheet asphalt on concrete foundation, also Congress St. between Summit Ave. and Paterson Plank Rd., old Belgian block. About $50,000 each. F. Dolan, clk.

N. J., Jersey City—Until July 7, by Hudson Co. Blvd. Comn., rebuilding Hudson Co. Blvd. between Fisher and Bergenline Aves. About $390,000.

Pa., Parnassus—Until July 6, by Boro. Secretary, improving Center Ave. from Puchety Creek Bridge to Riverview Drive, involving 2,500 cu.yd. excav., 700 lin.ft. storm sewers, 4,600 lin.ft. concrete curbing and guttering and 6,000 sq.yd. concrete paving. B. S. Dinsmore, New Kensington, engr.

Maryland—Until July 7, by State Rds. Comn., 601 Garrett Bldg., Baltimore, paving 1.94 mi. Belair Rd. from Old City Line to Hamilton Ave., Contr. BC-35; advertised in this issue.

Maryland—Until July 6, by State Rds. Comn., 601 Garrett Bldg., Baltimore, paving 2.1 mi. Philadelphia Rd. from end of sheet asphalt to New City Line, Contr. BC-34; advertised in this issue.

Maryland—Until July 6, by State Highway Comn., 601 Garret Bldg., Baltimore, graveling 6 mi. state highway from state road near Owensville toward Shadyside, Federal Aid Project 34, Contr. AA-15-A. J. N. Mackall, chn.; advertised in this issue.

Maryland—Until July 12, by State Highway Comn., 601 Garrett Bldg., Baltimore, paving 1.45 mi. Frederick Rd. from Old City Line to New City Line, Contr. BC-37. J. N. Mackall, chn.; advertised in this issue.

Maryland—Until July 12, by State Highway Comn., 601 Garrett Bldg., Baltimore, paving 2.75 mi. Harford Rd. from Old City Line to New City Line, Contr. BC-36. J. N. Mackall, chn.; advertised in this issue.

S. C., Charleston—Until July 6, by J. H. Dingle, city engr., for 100,000 sq.yd. sheet asphalt paving; advertised in this issue.

Georgia—Until July 6, by State Highway Dept., at office of div. engr., Clark Co. Court House, Athens, building 1.36 mi. Athens-Monroe Rd., Federal Aid Project 4, Oconee Co., involving 3.21 acres clearing and grubbing, 15,877 cu.yd. common and 1,770 cu.yd. rock excav., 5,000 cu.yd. top soil, 4,176 sta.yd. overhaul, 395 lin.ft. 18-24 in. drainage pipe, 27.16 cu.yd. Class "B" concrete in headwalls, also 30 ft. bridge over Griffeths Branch, involving 30.1 cu.yd. Class "A" and 7.8 cu.yd. Class "B" concrete, 229.6 cu.yd. cement rubble masonry, 220 cu.yd. wet and dry excav. and 5,675 lb. reinforcing steel.

Ky., Winchester—Until July 2, by Bd. Council, improving 75,000 sq.yd. streets asphalt, vitr. brick or concrete. G. T. Horine, city engr.; advertised in this issue.

O., Akron—Until July 9, by E. A. Zeisloft, dir. Pub. Serv., grading, paving and laying cement walks on 5 streets, also grading and laying cement walks on 12 streets involving 38,000 cu.yd. grading, 17,000 sq.yd. paving and 200,000 sq.ft. cement sidewalks; advertised in this issue.

O., Oak Harbor—Until July 2, by R. Gratop, village clk., grading, curbing and paving with concrete, Maple St. from Water to Portage Sts.

Streets and Roads (Continued)

Illinois—Until July 7, by State Highway Dept., Springfield, paving 3,000 ft. state highway, Sect. B, Route 1, 16 ft. wide, Mason Co., involving 5,333 sq.yd. concrete and 1,908 bbl. cement, cost $13,091; 3,226 ft. Sect. E, Route 7, 10 ft. wide, Lawrence Co., 3,585 sq.yd. concrete, 10.2 cu.yd Class A concrete and 1,138 bbl. cement, $9,854; 4,000 ft. Sect. I, Route 5, 16 ft. wide, Shelby Co., 7,111 sq.yd. concrete, 12.7 cu.yd. Class A concrete and 2,564 bbl. cement, $20,002; 4,400 ft. Sect. D, Route 1, 10 ft. wide, Ford Co., 4,889 sq.yd. concrete, 8.5 cu.yd. class A concrete, 1,768 bbl. cement and 640 lb. steel, $13,195; 4,150 ft., Sect. G, Route 2, 26 ft. wide, Jo Daviess Co., 11,988 sq.yd. earth, 46.1 cu.yd. Class A concrete, 68 bbl. cement and 1,922 lb. steel, $7,285. C. Older, ch. highway engr.

Wisconsin—Until July 7, by State Highway Comn., Madison, grading and paving Lake to River Rd., Federal Aid Project 140, Iowa Co., involving 0.72 acre clearing and grubbing, 45,944 cu.yd. earth, 18,024 cu.yd. rock and 1,105 cu.yd. loose rock excav., 192 cu.yd. borrow, 455.93 cu.yd. Class "A" concrete, 513 sq.yd. concrete surfacing, 370 lin.ft. concrete curbing, etc.

Wis., Mayville—Until June 29, by city, improving Main, School and Bridge Sts., etc., involving 17,500 sq.yd. rein.-con., asphalt, vitr. brick, asphaltic concrete or bitulithic, 500 lin.ft. curbing and guttering and 8,000 cu.yd. grading. J. Donohue, North 8th St., Sheboygan, engr. Noted March 18.

Wis., Milwaukee—Until June 28, by Comr. Pub. Wks., paving sections of various alleys, Atkinson and 27th Aves., Ontario, 16th, 17th and Wells Sts.

Minn., Breckenridge—Until July 7, by P. E. Traux, aud. Wilkin Co., grading 19 mi State Rd. 2, Federal Aid Project 166, Div. "A", involving 26 acres clearing and grubbing and 32,120 cu.yd. overhaul. About $95,000. J. F. O'Meara, Breckenridge, engr. Noted Jan. 8.

Minn., Caledonia—Until July 1, by E. N. Newhouse, aud. Houston Co., grading and graveling 22 mi. road from here to LaCrescent, 24 ft. wide. About $132,000. C. D. Conzett, Caledonia, engr. Noted March 11.

Minn., Mora—Until July 14, by A. V. Sander, aud. Kanabec Co., grading and graveling 16 mi. Federal Aid Project 91, State Rd. 2, 24 ft. wide. About $112,000. R. C. Streetly, Mora, engr. Noted March 30.

Kan., Ft. Scott—Until July 13, by Bourbon Co., grading and constructing culverts on 6.5 mi. Jefferson Highway, Project 6-A, 18 ft. wide, cost $75,000, also building 3.6 mi. Kansas City Rock Rd., Project 5-B, 18 ft. wide, bituminous macadam, $100,000. B. Boyle, Ft. Scott, engr.

Kan., Garden City—Until July 23, by Finney Co., building 10.1 mi. Old Santa Fe Trail, Project 22, Sects. F, G, H and I, 18 ft. wide, including grading and culverting, brick or concrete. About $450,000. R. J. Ruckel, Garden City, engr.

Kan., Girard—Until July 2, by Crawford Co., grading and building culverts on 2.98 mi. Commercial Highway, Project 40-H-I, 18 ft. wide. About $30,000. W. J. Arnold, Girard, engr. Noted April 29.

Kan., Kansas City—Until July 9, by Wyandotte Co., grading and building culverts on 3.99 mi. Fort to Fort Highway, 52-A-D, 18 ft. wide. About $40,000. O. K. Williams, Kansas City, engr.

Kan., Kansas City—Until July 9, by Wyandotte Co. and Leavenworth Co. (Leavenworth), building 7.968 mi. Federal Aid Project, Fort to Fort Rd., south of Lansing, concrete. Cost between $300,000 and $400,000. W. Beggs, clk. Wyandotte Co. and J. E. Vorhees, clk. Leavenworth Co.

Kan., Leavenworth—Until July 9, by Leavenworth Co., grading and building culverts on 4 mi. 52-B and 4.4 mi. 13-C, Fort to Fort Highway, 18 ft. wide. About $40,000 and $50,000 respectively. L. C. Clarke, Leavenworth, engr.

Kan., Lyons—Until July 7, by Rice Co., building 5 mi. brick highway on Old Santa Fe Trail, 26-B. About $300,000. S. Ainsworth, Lyons, engr.

Kan., Troy—Until July 12, by Doniphan Co., grading and building culverts on Pikes Peak highway, Project 53-ABC, 18 ft. wide. About $75,000. R. Atkins, Troy, engr.

Kan., Washington—Until July 8, by City Clerk, improving various streets, involving 18,141 sq.yd. pavement, 7,438 cu.yd. grading, 12,507 ft. combined curb and gutter.

Mo., Monticello—Until June 28, by Comrs. Lewis Co., building 7.94 mi. Red Ball Route Highway (La Grange Special Rd. Dist.), 24 ft. wide, Federal Aid Project 39, involving 30,882 cu.yd. earth and 650 cu.yd. rock excav., 5,692 cu.yd. borrow, 3,000 cu.yd. overhaul, 4.8 cu.yd. Class "A," 471.7 cu.yd. Class "B" and 94.1 cu.yd. Class "C" concrete masonry, 35,698 lb. reinforcement for concrete masonry, 177 lin.ft. 12-15 in. vitr. clay pipe, etc., cost, $87,335; building rein.-con. slab superstructure for Mitchell Bridge, to have two 20 ft. rein.-con. spans; 2 rein. con. abutments and 1 concrete pier, 3.9 Class "A," 104.7 cu.yd. Class "B" and 17.1 cu.yd. Class "C" concrete, and 8,500 lb. reinforcement.

Mo., Tarkio—Until June 28, by J. H. Capp, city clk., constructing 1,600 sq.yd. pavement, Tarvia, concrete or brick; advertised in this issue.

Tex., Canadian—Until July 1, by W. D. Fisher, judge Hemphill Co., grading, surfacing and draining 13.44 mi. Highway 4 from here to Lipscomb, Federal Aid Project 158, involving 2.8 acres clearing and grubbing, 39,391 cu.yd. borrow, 48,721 cu.yd. earth, 1,866 cu.yd. solid rock and 823 cu.yd. loose rock excav., 157.2 cu.yd. Class "A", 280.9 cu.yd. Class "B", and 32.16 cu.yd. Class "C" concrete, 51.8 cu.yd. 1:2:3 bituminous concrete, 11,307 cu.yd. clay, etc. About $82,748. Hess & Skinner, Southwest Life Bldg., Dallas, engrs. Noted April 22.

Tex., Richmond—Until July 3, by C. H. Chernosky, judge Fort Bend Co., grading, surfacing and draining 13 mi. Highway 36 from Rosenberg to Austin Co. line, involving 14,975 cu.yd. earth borrow, 105,894 cu.yd. unclassified excav., 350.49 cu.yd. Class "A" and 323.68 cu.yd. Class "B" concrete, 71,000 gal. asphalt, 29,535 lb. reinforcing steel, 3,000 cu.yd. cover material, 29,758.95 cu.yd. gravel etc. About $250,126, including 10 per cent for engineering and contingencies. Gurley & Gurley, Union Natl. Bank Bldg., Houston, engrs.

Tex., San Angelo—Until June 30, by C. T. Paul, judge Tom Green Co., grading surfacing and draining 10 mi. Highway 9 and 9-A, 16 ft. 9 in. wide, Federal Aid Project 145, involving 10,815 cu.yd. earth borrow and 19,627 cu.yd. earth excav. in roadway, 31,060 cu.yd. rock, 122.77 cu.yd. Class "A" and 70.52 cu.yd. Class "B" concrete, 163.31 cu.yd. 1:2:3 bituminous concrete, 2,097 cu.yd. cover material, 12,122 lb. reinforcing steel, 65,233 gal. bituminous material, etc. Cost $266,675. Former contract rescinded. J. A. Beavers, Son Angelo, engr. Noted June 17.

New Mexico—Until July 2, by State Highway Dept., Capitol Bldg., Santa Fe, building 15.41 mi. Federal Aid Project 34, including bridges, Rio Arriba Co., involving 42,490 cu.yd. Class 1, 3,148 cu.yd. Class 2 and 1,574 cu.yd. Class 3 excav., 2,500 cu.yd. borrow, 2,000 sta.yd. overhaul, 18,070 cu.yd. 1 course gravel surfacing, 1,276 lin.ft. 18-30 in. corrugated metal culvert, 78.38 cu.yd. Class "B" concrete in headwall, 27 cu.yd. Class "A" and 117 cu.yd Class "C" concrete, 2,750 lin.ft. concrete piling, etc. L. A. Gillett, state highway engr.

New Mexico—Until July 16, by State Highway Dept., Capitol Bldg., Santa Fe, building 32.411 mi. Federal Aid Project 18, including bridges, Eddy Co., involving 75,403 cu.yd. Class 1, 11,991 cu.yd. Class 1 (grader), 12,584 cu.yd. Class 2 and 1,144 cu.yd. Class 3 excav., 8,976 cu.yd. Class 1 and 8,650 cu.yd. Class 1 (grader) borrow, 12,668 sta.yd. overhaul, 186.2 cu.yd. cement rubble masonry, 2,030 lin.ft. 18-30 in. corrugated metal culvert, 136.04 cu.yd. Class "B" and 74 cu.yd. Class "C" concrete. L. A. Gillett, state highway engr.

New Mexico—Until July 6, by State Highway Dept., Capitol Bldg., Santa Fe, building 3.902 mi. Federal Aid Project 31, Sierra Co., involving 21,458 cu.yd. Class 1 excav., 429 cu.yd. Class 1 borrow, 7,753 sta.yd. overhaul, 4,578 cu.yd. 1 course gravel surfacing, 388 lin.ft. 18-24 in. corrugated metal culvert and 17.2 cu.yd. Class "B" concrete, etc.; 15,228 mi. Federal Aid Project 47, including bridges, Grant Co., 87,659 cu.yd. Class 1, 1,713 cu.yd. Class 2 and 1,531 cu.yd. Class 3 excav., 2,480 cu.yd. Class 1 borrow, 22,455 sta.yd. overhaul, 271 cu.yd. cement rubble masonry, 2,372 lin.ft. 18-36 in. corrugated metal culvert, 257 cu.yd. Class "A," 165 cu.yd. Class "B" and 137 cu.yd. Class "C" concrete, etc. L. A. Gillett, state highway engr.

New Mexico—Until July 17, by State Highway Dept., Capitol Bldg., Santa Fe, building 15.065 mi. Federal Aid Project 25, Curry Co., involving 50,426 cu.yd. Class 1 excav. 30,916 cu.yd., Class 1 borrow, 70,091 sta.yd. overhaul, 20,323 cu.yd. 1 course caliche surfacing, 52.90 cu.yd. Class "A," 202.4 cu.yd. Class "B" and 95.3 cu.yd. Class "C" concrete, etc.; 11.365 mi. Federal Aid Project 24, Roosevelt Co, 30,640 cu.yd. Class 1 excav., 6,225 cu.yd. Class 1 borrow, 36,335 sta.yd. overhaul, 40,004 cu.yd. 1 course caliche surfacing, 6.2 cu.yd. Class "A" and 29.2 cu.yd. Class "B" concrete, etc. L. A. Gillett, state highway engr.

New Mexico—Until July 10, by State Highway Dept., Capitol Bldg., Santa Fe, building 15.084 mi. Federal Aid Project 32 including bridges, San Miguel Co., involving 95,691 cu.yd. Class 1 and 2,960 cu.yd. Class 3 excav., 8,649 cu.yd. Class 1 borrow, 22,275 sta.yd. overhaul, 3,210 lin.ft. 18-36 in corrugated metal culvert, 188.4 cu.yd. Class "B," 56.6 cu.yd. Class "A" and 91.3 Class "C" concrete, etc.; 12,706 mi. Federal Aid Project 33, including bridges, Mora Co., 90,764 cu.yd. Class 1 and 11,822 cu.yd. Class 3 excav., 14,809 cu.yd. Class 1 borrow, 39,522 sta.yd. overhaul, 20,279 cu.yd 1 course gravel surfacing, 1,336 lin.ft. 18-36 in. corrugated metal culvert, 229 Class "B," 331 cu.yd. Class "A" and 860 cu.yd. Class "C" concrete etc. L. A. Gillett, state highway engr.

Utah, Payson—Until June 30, by city, paving 1.25 mi. 1st West St. to city limits, 20 ft. wide, plain concrete, bitulithic on concrete base, or crushed rock base. About $52,500.

Ore., Hood River—Until July 7, by Hood River Co., building 1.04 mi. concrete road between here and Odell. L. N. Blowers, co. judge.

Cal., San Diego—Until June 30, by Bd. Supervs. San Diego Co., concrete paving 7½ mi. Chula Vista-Corondo Rd., also 9½ mi El Cajon-Foster Rd. Noted June 10.

Cal., San Diego—Until July 1, by Bd. Supervs. San Diego Co., improving 4½ mi. Wynola Julian Rd., and 9½ mi. south from Escondido (5 alternate bids).

Que.—Until July 10, by B. Michaud, deputy minister of highways, Quebec, building 7 mi. Chemin de front du Bord de L'Eau, 20 ft. wide, gravel and waterbound macadam. About $75,000.

Que., St. Davids—Until July 3, by L. W. Joyal, secy. treas., building 2 mi. Chemin de Eglise, 14 ft. wide, macadam and concrete. Dept. Rds., Quebec, engr.

Que., St. Lambert—Until July 1, by town, building 2½ mi. Cote Noir Rd., 18 ft. wide bituminous macadam. About $75,000. E. Drinkwater, engr.

B. C., Victoria—Until June 28, by Dept. Pub. Wks., building 5.66 mi. Sirdar-Kuskanook Rd., 14 ft. wide, involving 17.2 acres clearing, 7,000 cu.yd. earth and 3,000 cu.yd. rock excav., 487 yd. gravel and 1,200 lin.ft. earth gutters. About $25,000. A. E. Foreman, Dept. Pub. Wks., engr.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

New Hampshire—State Highway Comn., Concord, received only bid June 2, building 3.6 mi. gravel highway, Tuftonboro Twp. from Vogel & Hadley, Manchester, $56,744. Noted May 27.

★Massachusetts—State Highway Comn., Boston, let contract building Acton-Littleton Rd., to G. E. Greenough, South Acton $98,874. Noted June 17.

Mass., Boston—City received bids June 14, paving Charles St. from Fruit to Allen Sts., wood block, from J. McCourt Co., 40 Wait St., Brookline, $17,972; J. Doherty, $18,386; Coleman Bros., Chelsea, $18,858. Archdale Rd. from Farquhar to McCraw Sts., (1) Topeka, (2) asphalt, from M. DeMatteo, 154 Dudley St., Roslindale, (1) $27,165, J. Landis, (1) $28,831, Central Constr. Co., 228 Southhampton St., Roxbury, (2) $31,573.

★Mass., Boston—City let contract grading, draining and building walks on Eagle Hill Reservoir, East Boston, to D. M. Biggs, $32,245. Noted June 17.

★Mass., Quincy—City let contract repaving 18 ft. track area in Hancock St., asphalt, to W. J. Barry, 439 Ashland St., Roslindale, $70,895. Noted May 27.

★Rhode Island—State Bd. Pub. Rds., State House, Providence, let contract rebuilding 2.29 mi. State Highway, North Kingstown, beginning 150 ft. south of Talbot's Corner, near Wickford Village and extending south on Post Rd., to Powers Bros., 167 North Montello St., Brockton, Mass., $103,932. Noted May 27.

★R. I., Bristol—Town let contract building concrete highway on Main St., to Callan Constr. Co., Bristol. About $70,000.

New York—F. S. Green, state highway comr., Capitol, Albany, received bids June 7, repairing roads in following counties: (a1) Orange Co., Rd. 312, (a2) Rd. 157, (b1) Suffolk Co., Rd. 693, (b2) Rd. 5300, (c) Albany Co., Rd. 5237, (d) Rensselaer Co., Rds. 10 and 25, (e) Jefferson Co., Rd. 182, (f) St. Lawrence Co., Rd. 1032, (g) Montgomery Co., Rd. 303, (h) Broome Co., Streets and Roads (Continued)

Rd. 126, (i) Steuben Co., Rd. 5253, (j) Tioga Co., Rd. 5215, (k) Chemung, Schuyler, Tioga and Tompkins Counties, Rds. 28, 355, 946, 1311, 1378, 5432, 999, 1005, 1190, 1420, 5335, 5432, 1232, 845, 927, 1078, 1079, 5257, 5471, 454, 455, 606, 1001, 1004, 1432, 5467, (1) Erie Co., Rds. 530 and 531, from Schunnemunk Contr. Co., Highland Mills, (a1) $170,583, (a2) $150,424; H. J. Mullen Contg. Co., Inc., Fulton St., Jamaica, (b1) $152,407, (b2) $43,884; Fleming, O'Brien & McEntegart, Inc., 401 West 59th St., New York City, (b1) $154,623, (b2) $45,507; Willite Rd. Constr. Co., 51 Chambers St., New York City, (c) $23,320; H. W. Roberts & Co., 610 Lansing St., Utica, (d) $85,207, (e) $104,152, (h) $71,134; J. E. Flood, Hudson Falls, (d) $85,467; W. J. Semper, Watertown, (e) $104,398, (f) $78,671; A. F. McConville, Ogdensburg, (f) $75,237; Spellman Oliver Co., Lake St., Chateaugay, (f) $76,668; Dale Eng. Co., Inc., Mann Bldg., Utica, (f) $77,438; L. D. Sullivan Co., Inc., Utica, (g) $48,346; R. Wemple, Fulton, (g) $51,652; J. P. Dugan & Co., Inc., Amsterdam, (g) $52,201; Lane Constr. Co., 37 Colony St., Meriden, Conn., (h) $70,738, (j) $43,981; Holloran Bros., Elmira, (i) $36,467; **A. A. Howard, Fairport,** (i) $36,876; J. W. Gurnett, Watkins, (i) $37,031, (k) $45,244; N. E. Young, Union, (j) $41,618; W. Hazard, Ithaca, (k) $45,569; J. J. Crouch, Watkins, (k) $46,926; Lathrop, Shea & Henwood Co., Ellicott Sq., Buffalo, $37,661. Noted May 20.

N. Y., Brooklyn—Park Rd., at office of Dept. Parks, Municipal Bldg., New York City, received bids June 10, furnishing labor and material improving Ocean Traffic Rd., sheet asphalt, from Brooklyn Alcatraz Asphalt Co., 407 Hamilton Ave., $99,788; Consolidated Asphalt Paving Co., 52 9th St., $103,578; Uvalde Asphalt Paving Co., 1 Bway., New York City, $101,780. Noted June 3.

★N. Y., Brooklyn—E. Riegelmann, boro. pres., let contract repaving Bedford Ave. from Heyward St. to DeKalb Ave., and from Quincy St. to Atlantic Ave., also paving West 25th St. from Mermaid to Neptune Aves., to Consolidated Asphalt Paving Co., 52 9th St., $79,372, $60,145 and $14,285 respectively; Bedford Ave. from Atlantic Ave. to Sterling Pl., to Uvalde Asphalt Paving Co., 1 Bway., New York City, $80,718; building sidewalks on Union St., to T. Bernhardt, $753. Noted June 10.

N. Y., College Point (Flushing P. O.)—M. E. Connolly, pres. Queens Boro., Long Island City, received bids June 21, repaving (a) 3rd Ave. from 1st to 13th Sts., (b) 5th Ave. from 21st St. to Whitestone Line, (c) 7th Ave. from 13th to 16th Sts., (d) 7th Ave. from 18th St. to Flushing Line, (e) Grand Ave. from Hopkins to Main Sts., (f) Grandview Ave. from Stanhope to Lincoln Sts., (g) Steinway Ave. from Flushing to Winthrop Aves., (h) regulating and grading southerly side of Boulevard from Beach 35th St. to bridge over Nortons Inlet, (i) 223rd St. from Hempstead Ave. to 105th St., (j) 104th Ave. from Farmers Blvd. to Hollis Ave., from H. J. Mullen Co., Fulton St., Jamaica, (a) $86,150, (b) $31,330, (d) $49,965, (j) $6,535; Kennedy & Smith, (a) $113,075, (g) $249,888, (h) $296; Tuohy & Upton, 90 Main St., Flushing, (b) $32,523, (d) $55,129, (i) $7,100; Peace Bros., 20 Main St., Flushing, (b) $32,790, (d) $57,920, (h) $300, (i) $2,570, (j) $6,700; Uvalde Asphalt Paving Co., 1 Bway., New York City, (c) $22,525, (e) $23,416, (f) $43,050; Sicilian Asphalt Paving Co., 41 Park Row, New York City, (e) $23,416, (f) $43,055; Cleveland Trinidad Paving Co., Flushing, (c) $23,597, (e) $23,198, (f) $43,950; Astoria Contg. Co., 169 Hunters Ave., Astoria, (g) $231,267; R. A. Hess, (h) $236; C. Kurth, 917 Forest Ave., Ridgewood, (i) $1,678. Noted June 17.

N. Y., Long Island City—M. E. Connolly, pres. Queens Boro., received bids June 18, regulating and grading roadway of Jackson Ave. from Junction Ave. to 51st St., also regulating and repaving outside railroad franchise area, etc., from Sicilian Asphalt Paving Co., 41 Park Row, New York City, $195,838 and $198,838 respectively; Uvalde Asphalt Paving Co., 1 Bway., New York City, $200,759 and $203,759 respectively. Noted June 10.

N. Y., New York—H. H. Curran, pres. Manhattan Boro., received bids June 18, repairing and restoring wood block and granite block pavements and foundation in railroad area, from Casper Helbroock Co., $78,540; W. J. Fitzgerald, 547 West 45th St., $109,050. Noted June 10.

★N. Y., New York—H. H. Curran, pres. Manhattan Boro., let contract paving and improving in railroad area when and where directed, also 72nd St., to Cleveland Trinidad Paving Co., Flushing, $173,400 and $17,309 respectively; Lexington Ave., 48th and 49th Sts., to Sicilian Asphalt Paving Co., 41 Park Row, $18,226, $3,036 and $3,362 respectively; 54th St., to Asphalt Constr. Co., 2197 Madison Ave., $11,075; 8th Ave., to J. L. Brusstar, Harlem River and 150th St., $107,478; 2nd Ave., to C. Helbroock, $25,285; Church St., to W. J. Fitzgerald, 547 West 45th St., $50,181. Noted June 3.

N. Y., S. I., St. George—C. D. Van Name, pres. Richmond Boro., received bids June 15, repairing with wood block pavement roadway of (a) Richmond Ave. from Richmond Terrace to south property line, (b) Richmond Terrace from York Ave. to Sailors Snug Harbor Dock, from J. Johnson Sons, (a) $31,182, (b) $26,720; Arco Constr. Co., (b) $28,741. Noted June 10.

★N. J., Montclair—City let contract paving and curbing Melrose Pl., to Standard Bitulithic Co., 50 Church St., New York City. About $48,000. Contract subject to the adoption of appropriation.

★N. J., Red Bank—City let contract, concrete paving 1 mi. Broad St., to Standard Bitulithic Co., 50 Church St., New York City, $102,023. Noted May 20.

Pennsylvania — State Highway Dept., Harrisburg, received bids June 15, paving roads in counties as follows:

Beaver Co., 1,606 ft. Route 77, Sect. 2 Rev. "L," from P. F. Connolly, Boston, $58,828; W. M. Keesecker and E. J. Kane, 1818 Wilson Ave., Youngstown, O., $61,979; J. C. Devine Co., Alliance, O., $65,386.

Bedford Co., 54,218 ft. Route 46, Sections 1 and 2, Providence and Hopewell Twps., from Union Paving Co., 30th and Locust Sts., Phila., $561,326; L. E. Kelly, 189 Montague St., Brooklyn, N. Y., $622,242.

Clarion Co., 3,203 ft., Shippenville Boro., from Red Bank Constr. Co., Inc., New Bethlehem, $66,632.

Clinton Co., 3,928 ft. Route 105, Chapman Twp. and Renova Boro., from T. E. Neylon, 217 9th St., Renova, $88,875.

Cumberland Co., 13,520 ft. Route 34, East Pennsboro Twp., from Ward & Tully, Inc., 2047 West 11th St., Brooklyn, N. Y., $279,809.

Delaware Co., 2,635 ft. Route 133, Upper Darby Twp. and Millbourne Boro., from C. E. Weed., Inc., Albany, N. Y., $36,084; W. C. Evans, Ambler, $37,942.

Jefferson Co., 1,684 ft. Route 64, Brookville Boro., from S. Van Shields, Brookville, $41,736; Humphrey, Sayer & Thompson, Brookville, $44,931.

Luzerne Co., 17,575 ft. Route 4, Sect. 4, Salem Twp., from Summit Contg. Co., 120 Broad St., Elizabeth, N. J., $241,566; Ward & Tully, Inc., 2047 West 11th St., Brooklyn, N. Y., $263,515; Sutton & Corson Co., 9th and Simpson Sts., Ocean City, N. J., $280,116.

Lycoming Co., 52,520 ft. Route 21, Sect. 4, Jackson, Cogan House and Lewis Twps., from Keystone State Constr. Co., Franklin Bank Bldg., Phila., $984,800; Porter Bros., Mt. Pocono, $1,007,688; Winston & Co., Muncy, $1,042,181.

Northampton Co., 7,441 ft. Routes 165 and 166, Bangor Boro., from C. E. Weed, Inc., Albany, N. Y., $110,673; R. D. Richardson Constr. Co., 828 Connell Bldg., Scranton, $116,361; Fish, Rutherford, Inc., 536 Real Estate Trust Bldg., Phila., $123,082.

Pike Co., 4,508 ft. Routes 8 and 167, Milford Boro., from H. B. Sproul Constr. Co., Inc., 218 Adams Ave., Scranton, $49,602.

Tioga Co., 42,052 ft. Route 196, Sections 1 and 2, Richmond and Tioga Twps., from F. L. Cohen, Inc., 1002 Prudential Bldg., Buffalo, N. Y., $590,557; Warren Bros. Co., 142 Berkeley St., Boston, $650,812; Adams, Evans & Co., 709 6th Ave., New York City, $691,228.

Venango Co., 50,025 ft. Route 233, Sect. 1, Victory and Sandy Creek Twps., from State Constr. Co., foot of 5th St., New Kensington, $804,689; C. F. Hamilton, Inc., 423 Trust Co. Bldg., Franklin, $829,404.

Washington Co., 34,837 ft. Route 115, Mt. Pleasant and Smith Twps., from S. Gamble Co., Carnegie, $475,646.

Westmoreland Co., 32,047 ft. Sect. 1, Derry Twp., from McCrady Bros. Co., 308 6th St., Braddock, $487,193; J. F. Casey, 935 Union Arcade Bldg., Pittsburgh, $492,090, also 2,609 ft. Route 118, Arona Boro., from J. Q. Dick, Scottdale, $40,550. Noted May 20.

Pennsylvania — State Highway Dept., Harrisburg, received bids June 16, paving roads in counties as follows:

Bedford Co., 20,870 ft. Route 46, Sect. 3, Hopewell Twp. from Union Paving Co., 30th and Locust Sts., Phila., $268,852.

Beaver Co., 26,953 ft. Route 204, Sect. 3, Darlington Twp. and Boro., from W. M. Keesecker and E. J. Kane, 1818 Wilson Ave., Youngstown, O., $414,297; Chester Genl. Contg. Co., P. O. Box 781, East Liverpool, O., $435,603; J. C. Devine Co., Alliance, O., $437,540.

Cumberland Co., 18,268 ft. Applications 231 and 394, East Pennsboro Twp. and West Fairview Boro., from Awixa Corp., $224,984.

Fayette Co., 14,496 ft. Route 247, Sect. 3, Perry and Jefferson Twps., from Petriello Bros. & Co., Brownsville, $250,183.

Jefferson and Clarion Counties, 39,261 ft. Route 64, Sections 2, 3 and 4, Corsica Boro., Union and Clarion Twps., from L. E. Kelly, 189 Montague St., Brooklyn, N. Y., $509,843; Red Bank Constr. Co., Inc., New Bethlehem, $574,195.

Northumberland Co., 26,200 ft. Route 161, Sect. 2, Shamokin, Rockefeller and Upper Augusta Twps., from Sutton & Corson Co., 9th and Simpson Sts., Ocean City, N. J., $326,035.

Tioga and Lycoming Counties, 72,004 ft. Route 21, Sect. 3, Hamilton, Bloss, Liberty and Jackson Twps. and Liberty Boro., from Porter Bros., Mt. Pocono, $1,255,633.

Pike Co., 3,549 ft. Route 8, Matamoras Boro., from H. B. Sproul Constr. Co., Inc., 218 Adams Ave., Scranton, $35,155.

Union Co., 5,960 ft. Route 176, Application 718, Gregg Twp., from T. L. Evans Sons, 344 Ferry St., Danville, $69,311; Fish, Young & Parks, 441 Hansbury St., Phila., $70,168; H. A. Moore Co., Inc., 66 Bway., Milton, $72,864.

Venango Co., 19,033 ft. Route 208, Sect. 1, Sandy Creek and French Creek Twps., from M. Dolan, 35 Fairmount Ave., Jamestown, N. Y. (1 course rein.-con.), $209,993; C. F. Hamilton, Inc., 423 Franklin Trust Co. Bldg., Franklin (bituminous macadam), $223,643; State Constr. Co., foot of 5th St., New Kensington (1 course rein.-con.), $239,524.

Westmoreland Co., 13,625 ft. Application 965, Derry Twp., from M. Bennett & Sons, Indiana, $190,931; McCrady Bros. Co., 308 6th St., Braddock, $206,121. Noted May 20.

★Pa., Pittsburgh—City let contract rebuilding and improving main approach to Allegheny County Soldiers Memorial, on 5th Ave., to North Side Constr. Co., 6939 Hamilton Ave., $29,929.

★Pa., Roslyn Farms (Carneigie P. O.)—Boro. let contract macadamizing various streets, involving 7,650 sq.yd. slag macadam, 6,800 lin.ft. stone guttering and 3,500 cu.yd. earth excav., to C. E. Worrel, Parnassus. About $30,000.

★Pa., Somerset—City let contract paving 4,000 ft. Stoyestown Rd. and Catherine St., 22 ft. wide, concrete on 5 concrete base, to Keller & Ferner, Somerset, $4.50 per sq. yd.

★W. Va., Charles—Kanawha Co. let contract grading and building bridge on 1.94 mi. Elk River Rd., to Brown & Floyd, 70 Lowenstein Bldg., $71,528.

★O., Columbus—Comrs. Franklin Co. let contract grading, constructing bridges and culverts and paving 1.87 mi. Elliott Rd., 16 ft. wide, macadam, to W. O. Jewett, Plain City, $54,260. Noted June 3.

Mich., Detroit—City received bids grading, excavating and paving with new 1 course concrete, 2 x 6 in. retaining plank and Medina headers (a) Alley 1,162 between Chicago Blvd., 12th, Wilson and Longfellow Aves., 20 ft. wide, (b) 1,163 between Seminole, Iroquois, Warren and Moffat Aves., 20 ft. wide, (c) 1,164 between Townsend, Baldwin, Canfield and Forest Aves., 18 ft. wide, (d) 1,165 between Holcomb, Belvidere, Charlevoix and Goethe Aves., 18 ft. wide, (e) 1,166 between Fisher, Crane, Canfield and Forest Aves., 18 ft. wide, (f) 1,167 between 12th, Wilson, Edison and Longfellow Aves., 20 ft. wide, (g) 1,168 between Pennsylvania, Cadillac, Waterloo and Charlevoix Aves., 20 ft. wide, (h) 1,169 between 14th, 12th and Euclid Aves. and Virginia Park, 18 ft. wide, (i) 1,170 between John R. and Brush Sts., Englewood and Woodland Aves., 20 ft. wide, (j) 1,171 between Concord, Canton, Waterloo and Charlevoix Aves., 18 ft. wide, (k) 1,172 between Cratiot, Elmwood, Ludden and Mack Aves., 20 ft. wide, (l) 1,173 between Grand River, Avery and Alexanderine Aves., 18 ft. wide, from Otis Cement Constr. Co., 806 Hammond Bldg., (a) $7,847, (b) $8,686 (c) $6,915, (d) $7,664, (e) $6,625, (f) $7,684, (g) $7,068, (h) $8,524, (i) $8,043, (j) $7,644, (k) $1,723, (l) $1,723; R. J. Powelson & Co., 1577 Iroquois Ave., (a) $7,446, (b) $8,337, (c) $6,889, (d) $7,621, (e) $6,593, (f) $7,301, (g) $6,835, (h) $8,656, (i) $7,853, (j) $7,367, (k) $2,968, (l) $1,752; T. E. Currie, 20 McGraw Bldg., (b) $7,850, (d) $6,949, (g) $6,162; Lester & Shepard, 400 Penobscot Bldg., (c) $6,525, (e) $6,337, (j) $7,224; R. A. Mercier, 746 Hudson Ave., (i) $7,708, (k) $2,922, (l) $1,636.

Streets and Roads (Continued)

★**Kan., Fredonia**—Wilson Co. let contract hauling and spreading gravel surfacing on 25 mi. Capitol Highway, Project 43, 16 ft. wide, involving 47,100 cu.yd. gravel to C. C. Baker, Humboldt, $151,780. Noted Feb. 5.

Kan., Garden City—Finney Co. received bids grading, paving and culverting 17.6 mi. Old Santa Fe Trail, Project 22, Sects. A, B, C, D and E, 18 ft. wide, from M. R. Ammermann, Wichita, $39,600 per mi.; A. L. Cook, Ottawa, for excav., $0.54, and borrow $0.48 per cu.yd.

★**Kan., Wellsville**—City let contract grading and paving 19,200 sq.yd. various streets, 8 in. concrete base, to Cock & Stucker, Ottawa. About $69,000. Noted June 10..

★**Montana**—State Highway Dept, Helena, let contract improving 1.995 mi. Lower Polytechnic Highway, concrete, Federal Aid Project 52, Yellowstone Co., to F. Soner, Great Falls, cost, $93,586; 0.703 mi. Railroad Ave. and Division St., concrete, Federal Aid Project 69, Whitehall Twp., to L. F. Lepp, Whitehall, $31,963; 18.47 mi. Grass Range Roundup Highway, earth, Federal Aid Project 27-28, Fergus Co., to Walker & Anderson, Roundup and Security Bridge Co., Billings, total, $136,592; surfacing 12.64 mi. Chinook-Havre Highway, gravel, Fed-Eng. Co., Chinook, and Buell Bridge Co., Missoula, $152,583; also building Savoy Creek Bridge, 75 ft. steel pony truss, Federal Aid Project 8, and Fifteen Mile Creek Bridge, 60 ft. steel truss, Federal Aid Project 81, both Blaine Co., to Buell Bridge Co., Missoula, $11,767 and $8,823 respectively.

★**Mont., Kalispell**—Comrs. Flathead Co. let contract clearing and grading 30 mi. road from Coram up South Fork of Flathead River in forest reserve, involving 60,000 cu.yd. common earth and 25,000 cu.yd. solid rock excav., 2,500 lin.ft. corrugated metal culverts, also building one 60 ft. queen truss bridge with five 40 ft. and three 30 ft. spans and several small stringer bridges, all made of logs, to Siems & Carlson, Realty Bldg., Spokane, Wash., About $200,000.

★**Mo., Bethany**—Comrs. Harrison Co. let contract building 9.39 mi. Sect. A, Jefferson Highway, 24 ft. wide, Federal Aid Project 8, involving 63,583 cu.yd. earth and 400 cu.yd. rock excav., 407 cu.yd. borrow, 389 cu.yd. Class "B" and 470 cu.yd. Class "C" concrete, 34,269 lb. reinforcement, 565 lin.ft. 15-24 in. vitr. clay pipe, etc., to F. D. Wilson & Co., Bethany, $74,876.

★**Ark., Marion**—Rd. Impvt. Dists. 7, 8 and 9, Crittenden Co., (Marion) and Ozark Trail Rd. Impvt. Dist., Poinsett Co. (Harrisburg) let contract hauling and gravel surfacing 110 mi. road, to G. H. Pride, 47 West 34th St., New York City.

★**Tex., Eastland**—Comrs. Eastland Co. let contract improving 150 mi. bituminous macadam highway, 20 mi. concrete and 39 mi. sand clay or gravel, to Fleming & Stitzer, Ranger. About $5,000,000, cost plus percentage basis. Noted May 27.

Tex., Eldorado—Comrs. Schleicher Co. received bids June 8, for (a) surfacing 7.3 mi. Highway 4, San Angelo-Sonora Rd., 16 ft. wide, involving 35,324 cu.yd. earth borrow excav. and 23,155 cu.yd. stone, (b) building drainage structures on same, involving 201.67 cu.yd. Class "A," 106.7 cu.yd. Class "B" and 55.3 cu.yd. 1:2:3 concrete, 17,009 lb. reinforcing steel, etc., from Schleicher Co., c/o C. A. Womack, judge, Eldorado, (a and b) $153,254; McCall-Moore Eng. Co., 308-309 Amicable Bldg., Waco, (b) $24,647.

Tex., Laredo—Comrs. Webb Co. received bids June 7, surfacing and building rein.-con. drainage structures on 17.6 mi. Highway 12, Federal Aid Project 118, from B. S. Davidson, Houston, $145,423, W. T. Montgomery, Alamo Bank Bldg., San Antonio, $151,204, W. B. Kroeger and D. M. Basye, San Antonio, $156,749. Work involves 10 acres clearing and grubbing, 50 stations light clearing and grubbing, 81,038 cu.yd. borrow, 19,293 cu.yd. earth excav. in roadway, 1,000 cu.yd. loose and 500 cu.yd. solid excav., 1,563.88 cu.yd. Class "A," 333.17 cu.yd. Class "B," and 69.92 cu.yd. Class "C" concrete, 151,149 lb. reinforcing steel, etc. Noted June 3.

★**Tex., Montague**—Montague Co. let contract gravel surfacing and building rein.-con. culverts and steel bridges on 11.676 mi. Highway 2, Meridian Rd., to Montague Co., c/o W. T. Russell, co. judge, $98,195. Noted May 27.

Tex., San Antonio—Baxar Co. received bid June 8, surfacing 6.677 mi. Highway 2, Pearsall Rd., 18 ft. wide, Federal Aid Project 31, (a) trap rock, (b) Uvalde rock asphalt, from Ririe & Montondan, 223 South Pinto St., (a) $40,427; Chapin-Coglazier Constr. Co., Moore Bldg., (b) $41,367; Uvalde Rock asphalt Co., Swearingen Bldg., (b) $43,247. Noted June 3.

Tex., Van Horn—Culberson Co. received bids improving (a) 23.356 mi. Highway 12, Van Horn-Dougherty Rd., involving 58 acres clearing, and grubbing, 11,084 cu.yd. borrow, 12,750 lin.ft. road grader work, 14.52 cu. yd. 1:3:6 concrete headwalls, and 1,716 cu.yd. gravel surfacing, (b) 43.167 mi. Highway 1, 35,000 cu.yd. ditching and hauling, and 30,200 cu.yd. gravel surfacing, from W. E. Hamilton, Mineral Wells, (a) $35,550, (b) $117,952; Thomas & Ratcliff, Rogers, (a) $35,402, (b) $123,226; Lee Contg.-Constr. Co., Lovington, N. M., (a) $41,816, (b) $120,577.

★**Col., Ft. Collins**—City will build 4,900 sq.yd. 6 in. rein.-con. pavement, 687 cu.yd. earth excav. and 610 lin.ft. concrete gutters, etc. Work will be done by day labor. Noted March 18.

★**N. M., Raton**—City let contract improving portion Impvt. Dist. 3, involving 42,000 cu.yd. excav. and 23,170 lin.ft. curbing and guttering, to Odell Bros., Raton. About $72,000.

Idaho—State Highway Dept., Boise, received bids June 5, grading and surfacing with crushed rock (a) 8.9 mi. Idaho-Pacific Highway from Pocatello to McCammon, 18 ft. wide, Federal Aid Project 15, (b) 9 mi. Idaho-Utah Highway from Downey to Franklin Co. line, 18 ft. wide, Federal Aid Project 17, Bannock Co., from Morrison & Knudsen, Railroad and Reclamation Aves., Boise, (a) $109,227, (b) $99,839; J. J. Carrol & Co., 1012 North 19th St., Boise, (a) $117,408, (b) $109,111. Noted May 27.

★**Idaho**—State Highway Dept., Boise, let contract grading 4.26 mi. Gooding-Rupert Highway between Jerome and Hazelton, 18 ft. wide, Jerome Co., involving 19,024 cu.yd. earth and 6,727 cu.yd. rock excav., 74 cu.yd. concrete, 2,578 lb. reinforcing steel and 670 ft. pipe culvert, to S. Smith, Jerome, $55,535. Surfacing above project with crushed rock will be done by force account.

★**Utah, Manti**—San Pete Co. and Emery Co. (Castle Dale) will grade and surface 51 mi. Salina-Emery Post Rd., 16 ft. wide, gravel or shale. About $60,000. Work will be done by day labor.

★**Ariz., Florence**—Pinal Co. Highway Comn. let contract grading 5 mi. Ray-Kelvin Rd., involving 45,678 cu. yd. rock and 9,638 cu.yd. earth excav., 550 cu.yd. dry rubble masonry, 2,800 ft. earth and rock ditches, etc., to B. H. Gallegher & Co., Phoenix, $82,861. Noted May 13.

★**Wash., Port Angeles**—City let contract grading and paving with concrete 1st St. from Lincoln to Valley Sts., to P. J. Woods & Co. Port Angeles, $77,740.

★**Wash., Seattle**—City let contract grading, building concrete walks, sewers et al on 41st Ave. et al, involving 8,925 lin.ft. concrete sidewalk, 27,000 cu.yd. earth excav., 2,500 lin.ft. 3 in. and 1,294 lin.ft. 8 in. sewer pipe, to Scalzo & Co., 1798 22nd Ave. S., $132,893.

Wash., Seattle—Comrs. King Co. received bids grading and graveling 2 mi. North Park Impvt. Club Rd., 24 ft. wide, from H. Pederson, 7307 Greenwood Ave., $68,500, F. Agostino Bros. Co., 1335 21st Noted May 27.

★**Oregon**—State Highway Comn., Portland, let contract paving Youngs Bay-Miles Crossing Sect., Astoria Seaside Project Coast Highway, 18ft. wide, involving 3,500 lin.ft., 7 in. concrete (mixer to be furnished by Highway Dept.), to Northwestern Constr. Co., Portland, $19,226; grading 6.9 mi. Mayville-Thirtymile Creek Sect. John Day River Highway, Gilliam Co., from Mayville to point about 6 mi. south of Condon, 91,500 cu.yd. excav., etc., to Copenhagen Bros., Yeon Bldg., Portland, iron pipe, $109,880; .2 mi. Ashland Overcrossing Approaches, Pacific Highway, about 3 mi. southeast of railroad section at Ashland, Jackson Co., to C. H. Natwick, Portland, $11,630; .9 mi. Ontario-Snake River Sect. Old Oregon Trail, Melheur Co., 8,350 sq.yd. 6 in. concrete paving, 3,500 cu.yd. excav., 465 lin.ft. culvert pipe, to Gilmore & Ritchie, Baker, $28,420; grading and surfacing 10.5 mi. Pilot Rock-Pendleton Sect., Oregon-Washington Highway, Umatilla Co., 58,000 cu.yd. excav., 80 cu.yd. concrete, 22,000 cu.yd. crushed gravel, etc., to Umatilla Co. Court, Pendleton, $112,224; also building 1 combined crossing over Spanish Gulch and Shaniko branch of Oregon Washington R.R. Navigation Co. on Columbia River Highway near Biggs, Sherman Co., 90 cu.yd. Class "B" concrete, 330 lin.ft. standard wooden trestle, etc., to Hord-Brooks Co., 737 Clatsop Ave., Portland, $19,799.

★**Ore., The Dalles**—City let contract paving 7½ blocks Bluff St., Lower West Link Dalles City-Columbia River Highway and widening Brewery Grade, to United Contg. Co., Northwest Bank Bldg., Portland, $27,605, $7,623 and $5,713 respectively; masonry work on Brewer Grade, to Tranzano Bros., The Dalles, $5,480.

California—State Highway Dept., Forum Bldg., Sacramento, received bids June 14, building Route 3, Sect. D, Div. 2, Federal Aid Project 42, Los Molinos to Red Bluff, Tehama Co., from L. S. Atkinson, Jr., 1124 5th St., Sacramento, $243,594. Work involves 50,000 cu.yd. excav. at $1.10 per cu. yd., 14,300 cu.yd. Class "A" Portland cement concrete (pavements), $12.22, 400 cu.yd. Class "A" Portland cement concrete (culverts and monuments), $25, corrugated metal pipe, 1,200 lin.ft. 12 in., $1.00, 650 lin.ft. 18 in., $1.25 and 600 lin.ft. 24 in., $1.50, etc. Noted May 27.

★**Cal., Los Angeles**—Bd. Supervs. Los Angeles Co. let contract improving 22,000 ft. Lancaster-Terra Bonita Rd., Rd. Impvt. Dist. 155, 18 ft. wide, involving 9,138 cu.yd. excav., 14,470 ton granite in 6 in. pavement, 270 ft. corrugated iron pipe, etc., to Rogers Bros. Co., 350 Merrick St., $68,900. Noted May 6.

Cal., Los Angeles—Bd. Supervs. Los Angeles Co. received bids building 2.43 mi. Rd. Impvt. Dist. 145, near Puente, 22 ft. wide, involving grading, 5 in. oil macadam paving, 540 ft. corrugated iron pipe culverting, etc., from C. W. Sparks, 257 South Lake St., $31,000; G. T. McLain, 1184 North Berendo St., $37,000; Rogers Bros. Co., 350 Merrick St., $37,800.

★**Cal., San Bernardino**—City let contracts to Los Angeles Paving Co., 2900 Santa Fe Ave., Los Angeles, improving 3rd St., involving 110,000 sq.ft. binder course and 2 in. Warrenite surfacing, at $0.205 per sq.ft. for surfacing, $12.50 per ton for binder material; also paving 2nd St., 20,000 sq.ft. 1½ in. Warrenite, $0.199. Noted April 8.

★**Cal., Santa Monica**—City let contract improving San Vicente Blvd., to J. D. Kneen Contg. Co., Dudley Bldg., $112,692, involving 461,139 sq.ft. grading at $.029 per sq.ft., 461,139 sq.ft. bitulithic paving, $0.199, 1,021 ft. cement curbing, $0.59 and radial brick storm drain, $6,950. Noted June 17.

★**Cal., Seeley**—City let contract paving 1 mi. main streets, 4 in. concrete, to G. H. Oswald, 366 East 58th St., Los Angeles About $42,000.

★**Cal., Visalia**—Tulare Co. let contract grading and paving 6.507 mi. Orosi-Orange Cove Rd., involving 3,904 cu.yd. excav. and 6,393 cu.yd. concrete paving, to Davey & Kilmer, 32 Orange St., Long Beach, $48,305. Noted May 27.

★**Ont., North Bay**—Town let contract paving 1 mi. Main St., 42 ft. wide, bitulithic on concrete base, to Warren Bituminous Paving Co., McKinnon Bldg., Toronto. About $100,000. Noted May 6.

Railways

PROPOSED WORK

Tennessee—Tennessee Valley Iron & Ry. Co., Collinwood, plans to build 15 mi. line from Collinwood to Wayne furnace ore fields, to develop iron and timber resources.

Ontario—Canadian Pacific Ry., Windsor St., Montreal, Que., plans to build 4-6 mi. yard sidings, also 1 story, brick and wood freight shed at Windsor. About $450,000. W. Fairchild, engr.

Excavation and Dredging

PROPOSED WORK

Ark., Lake Village—Ditches—Eudora Western D. D. having plans prepared by Baxter Eng. Co., engrs. Moore & Turner Bldg., Little Rock, for 175 mi. ditches to drain 120,000 acres of land.

Ark., Readland—Ditches—Grand Lake D.D. receives bids about July 1, building 25 mi. ditches, 10-30 ft. bottoms, involving 750,000 cu.yd. dragline excav. Baxter Eng. Co., Moore & Turner Bldg., Little Rock, engrs.

BIDS DESIRED

Miss., Belzoni—Dredging—Until July 17, by Belzoni Drainage Comn., redredging 100 mi. drainage ditches, 14 ft. bottom. C. E. Miller, engr., Citizens Bank & Trust Co. Bldg.

Ky., Paducah—Drainage—Until July 6, by McCracken Co. Drainage Comrs., building Mayfield D. D. 1. J. W. Fry, pres.; advertised in this issue

Ia., Montezuma—Dredging—Until July 7, by C. H. Young ch. engr., Central States Eng. Co., Muscatine and W. C. McKee, aud. Poweshiek Co., building drainage improvements in Bear Creek D.D. 1 and 2.; advertised in this issue.

Excavation and Dredging (Continued)

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

★Miss., Greenville—Ditch—Riverside D. D. let contract building open ditch, with 6-10 ft. base, to reclaim area, here, involving 70,000 cu.yd. dryland dredge work, to Arpin Dredging Co., Grand Rapids, Mich., at $0.37½ and $0.45 per cu.yd.

Industrial Works

PROPOSED WORK

N. H., Portsmouth—Kendall, Taylor & Co., archts and engrs., 93 Federal St., Boston, soon lets contract building 2 story, 30 x 50 ft., brick and concrete boiler house and laundry and 15 x 30 ft. concrete coal pocket, rein.-con. flooring, concrete foundation, for Portsmouth Hospital.

Mass., Boston—Edison Electric Illuminating Co., 70 State St., plans to build large 1 story power station on Bway. Private plans.

Mass., Boston—Foss & Co., Inc., 595 Atlantic Ave., plans to build storehouse to replace one recently destroyed by fire. Loss $250,000. Private plans.

Mass., New Bedford—T. M. James, archt., 3 Park St., Boston, soon lets contract altering and building 3 story, brick and mill construction addition to plant, concrete foundation, on Church St. and Nash Rd., for W. C. Jones Co. About $75,000.

Mass., Pittsfield—General Electric Co. soon lets contract building 1 story, 100 x 400 ft., brick, concrete and steel plant, concrete flooring and foundation. Private plans. Noted April 22.

R. I., Bristol—Jenks & Ballou, engrs., 1035 Grosvenor Bldg., Providence, soon let contract building 4 story, 100 x 130 ft., brick and mill construction addition to plant, rock or concrete foundation, for Cranston Worsted Co. About $100,000. Noted June 3.

R. I., Providence—Cudahy Packing Co., 346 Canal St., soon receives bids building 3 story, 40 x 100 ft., brick and rein.-con. packing plant, rein.-con. flooring, concrete foundation, on Canal St. About $50,000. Private plans.

R. I., Providence—Packard Motor Car Co., Bway. and 161st St., New York City, soon lets contract building 2 story, 190 x 205 ft., brick and rein.-con. garage, service station and salesroom, rein.-con. flooring, concrete foundation, on Plenty St., here. About $400,000. Private plans.

Conn., Meriden—I. Moskowitz, 3 Perkins St., having plans prepared by D. Bloomfield, archt., 52 Sherman Ave., for 3 story, brick and steel warehouse and freight elevator, concrete foundation. About $50,000.

Conn., Montville—R. Gair Paper Corp., Thomas River Div., soon lets contract building 2 story, 250 x 400 ft., plant and 1 story, 50 x 50 ft. power house, brick, concrete and steel, rein.-con. flooring, concrete foundations. About $500,000. Private plans.

Conn., Norwich—U. S. Finishing Co., Greenville, having plans prepared by Day & Zimmermann, archts. and engrs., 611 Chestnut St., Phila., rebuilding boiler plant. About $300,000.

N. Y., New York—J. M. Felson, archt. and engr., 1133 Bway., soon lets contract building 3 story, rein.-con. and steel garage and service station, rein.-con. flooring, concrete foundation, on Manhattan and 130th Sts., for S and Z Bldg. Co., care of architect. About $120,000.

N. Y., New York—J. W. Felson, archt. and engr., 1133 Bway., soon lets contract altering brick, rein.-con. and steel garage, rein.-con. flooring, for S. Varschleisser, 215 East 67th St. About $50,000.

N. Y., Richmond Hill (Jamaica P. O.)—C. Bauer, archt. and engr., 788 Manhattan Ave., Brooklyn, receives bids about July 6, building 3 story, 60 x 100 ft., brick and steel factory, rein.-con. flooring, concrete foundation, here, for R. M. Krauser, c/o architect. About $80,000. Noted June 10.

N. Y., Yonkers—Yonkers Electric Light & Power Co. having sketches made by W. Whitehill, archt. and engr., 55 Duane St., New York City, for brick, concrete and steel substation, rein.-con. flooring, concrete foundation. About $150,000.

N. J., Newark—Clark Thread Co., Clark and Ogden Sts., soon lets contract constructing 4 story, 82 x 300 ft. and 5 story, 60 x 200 ft. additions to factory, concrete and brick. Private plans.

Pa., Phila.—Hale & Kilburn Corp., 18th and Lehigh Sts., having plans prepared by Day & Zimmermann, archts. and engrs., 611 Chestnut St., for altering plant, concrete and brick. About $60,000.

Pa., Pittsburgh—Prest-O-Lite Co., 30 East 42nd St., New York City, receives bids about June 25, constructing additions

SUBWAY—NEW YORK, N. Y.

Bids were received by Transit Constr. Comn., 49 Lafayette St., for completion of Route 8, Sect. 2, of 14th St.-Eastern District Rapid Transit R.R., from (A) Patrick McGovern, 50 East 42nd St.; (B) Booth & Flynn, Ltd., 17 Battery Pl.; (C) Underpinning & Foundation Co., Inc., 290 Broadway. The unit bids were as follows:

	A	B	C
36,200 cu.yd. earth excavation above M.H.W.	$10.00	$12.47	$10.00
55,000 cu.yd. back filling	7.75	2.25	10.00
35,800 cu.yd. earth excavation below M.H.W.	11.50	11.46	10.00
7,700 cu.yd. earth excavation above and below M.H.W. for sewers, pipes and ducts	11.50	8.56	10.00
10,500 cu.yd. rock excavation	19.00	15.92	10.00
100 cu.yd. rock excavation for sewer pipes and ducts	19.00	14.54	10.00
1,700 fr.ft. underpinning buildings less than seven stories	4.25	100.00	90.00
50 fr.ft. underpinning buildings from seven stories to twelve	4.25	110.00	90.00
1,500 lin.ft. for protecting and securing buildings	4.00	110.00	90.00
27,600 cu.yd. concrete masonry in place	23.50	22.00	20.00
4,200 cu.yd. protective concrete masonry	23.50	22.00	20.00
2,850 cu.yd. rubblestone masonry	15.00	10.00	16.00
800 cu.yd. dry rubble masonry	11.00	5.00	10.00
50 cu.yd. brick masonry	38.00	40.00	40.00
70 cu.yd. hollow terra cotta brick tile masonry	33.40	41.00	40.00
1,000 bbl. Portland cement grout	6.50	7.50	10.00
1,000 lin.ft. timber piles	1.00	2.00	5.00
2 M.ft.b.m. timber foundations	150.00	150.00	140.00
10 cu.yd. broken stone or gravel	5.50	7.00	9.00
26,900 sq.yd. one-ply waterproofing	1.30	1.50	.80
100 sq.yd. two-ply waterproofing	1.85	1.95	1.25
18,150 sq.yd. three-ply waterproofing	2.40	2.50	2.00
100 sq.yd. four-ply waterproofing	2.95	2.95	2.50
100 sq.yd. five-ply waterproofing	3.50	3.80	3.00
4,900 sq.yd. six-ply waterproofing	4.05	5.00	3.60
100 sq.yd. dry-ply waterproofing	.80	1.00	.80
4,300 cu.yd. brick laid in asphalt mastic	50.00	50.00	60.00
50 lin.ft. 12-in. vitrified drain pipe	1.80	2.60	2.25
50 lin.ft. 10-in. vitrified drain pipe	1.55	2.40	2.00
50 lin.ft. 8-in. vitrified drain pipe	1.25	2.20	1.50
50 lin.ft. 6-in. vitrified drain pipe	.70	1.85	1.25
300 lin.ft. 4-in. vitrified drain pipe	.60	1.65	1.00
100 lin.ft. 6-in. cast-iron drain pipe	2.50	3.05	3.00
100 lin.ft. 4-in. cast-iron drain pipe	1.60	2.50	2.50
50 lin.ft. 10-in. cast-iron drain pipe	4.75	3.40	3.50
200 lin.ft. 3-in. cast-iron pipe, fittings and specials extra heavy	1.60	2.25	2.25
150 lin.ft. 4-in. cast-iron pipe, fittings and specials extra heavy	2.10	2.75	3.00
400 lin.ft. 6-in. cast-iron pipe, fittings and specials extra heavy	3.20	3.50	4.50
500 lin.ft. 8-in. cast-iron pipe, fittings and specials extra heavy	4.45	4.00	6.00
100 lin.ft. 3-in. galv. w.-i. pipe fittings and specials, extra heavy	1.60	2.00	1.50
100 lin.ft. 6-in. galv. w.-i. pipe, fittings and specials, extra heavy	4.00	4.50	3.00
131,560 duct ft. tunnel ducts	.20	.35	.30
1,400 tons riveted steel (completion)	66.00	80.00	63.00
1,827 tons steel beams and shapes (completion)	66.00	80.00	63.00
50 tons steel rods and bars	130.00	200.00	200.00
157 tons steel rods and bars built in concrete (completion)	35.00	75.00	63.00
30 tons miscellaneous iron castings	110.00	170.00	300.00
2 tons miscellaneous iron furnishings for manholes and basins	140.00	170.00	3.00
1,130 lbs. special wire forms	.15	.50	.50
4,260 lin.ft. 1¾-in. hand rail	.50	.50	.60
4,740 sq.ft. steel gratings	3.50	5.50	4.50
1,400 sq.ft. vault lights	2.50	2.25	2.40
7,770 sq.yd. restoration of sidewalks	2.00	4.00	3.75
10,770 sq.yd. asphalt pavement restoration	6.00	6.00	6.00
7,450 sq.yd. granite block pavement restoration	10.00	5.00	6.00
300 sq.yd. Belgian block restoration	10.00	4.00	6.00
850 lin.ft. bluestone curb in place	2.25	2.00	1.50
880 sq.yd. wooden block pavement	8.00	7.00	6.00
850 lin.ft. new 8-in. granite curb	4.00	7.00	3.00
6,100 lin.ft. ¾-in. conduits, w.-i.	.45	.40	.25
300 lin.ft. 1½-in. conduits, w.-i.	1.00	1.00	.50
200 lin.ft. 2-in. conduits, w.-i.	1.50	2.00	.80
5,000 lin.ft. 1-in. conduits, w.-i.	.70	.75	.40
800 cast-iron outlet boxes	1.50	1.00	2.00
10 cast-iron pull boxes	10.00	10.00	2.00
100 lin.ft. cast-iron pipe and fittings, 6-in. extra heavy	3.20	4.50	4.50
100 lin.ft. cast-iron pipe and fittings, 3-in. extra heavy	1.60	2.50	2.50
110 lin.ft. 12-in. vitrified pipe sewer	3.55	8.00	10.00
1,430 lin.ft. 15-in. vitrified pipe sewer	4.65	11.00	11.00
1,250 lin.ft. 18-in. vitrified pipe sewer	5.95	14.00	12.00
375 lin.ft. 20-in. vitrified pipe sewer	7.10	15.00	13.00
360 lin.ft. 22-in. vitrified pipe sewer	8.35	16.00	14.00
600 lin.ft. 24-in. vitrified pipe sewer	9.40	17.00	15.00
6 tons cast-iron sewer pipe, straight	140.00	80.00	150.00
4 tons cast-iron sewer pipe, special	260.00	160.00	250.00
1,550 lin.ft. 3 ft. 6 in. by 2 ft. 4 in. egg-shaped sewer	11.20	25.00	20.00
650 lin.ft. 4 ft. by 2 ft. 8 in. egg-shaped sewer	14.00	30.00	24.00
160 lin.ft. 4 ft. circular sewer	19.50	25.00	25.00
160 lin.ft. 5-ft. circular sewer	26.00	25.00	42.00
8,430 lin.ft. electric underground R.R. single track	12.00	10.00	15.00
260 lin.ft. independent motor R.R. single track	7.00	5.00	15.00
2 elevated R.R. col. supported on structure	1,800.00	1,750.00	13,000.00
2 elevated R.R. col. supported partly or off R.R. structure	1,800.00	2,000.00	13,000.00
2 elevated R.R. col. supported on R.R. structure (completion)	1,500.00	1,750.00	8,000.00
2 elevated R.R. col. supported partly or off R.R. structure (completion)	1,500.00	2,000.00	8,000.00
110 lin.ft. 6-in. water pipe	.80	1.00	.50
3,050 lin.ft. 12-in. water pipe	1.50	2.00	1.00
1,710 lin.ft. 36-in. water pipe	4.50	6.00	4.00
115 lin.ft. 48-in. water pipe	6.50	8.50	5.00
70 service connections for water pipe	35.00	60.00	30.00
1,605 lin.ft. 4-in. cast-iron gas pipe	.50	.90	.25
5,400 lin.ft. 6-in. cast-iron gas pipe	.75	1.00	.50
660 lin.ft. 8-in. cast-iron gas pipe	1.00	1.50	.75
25 lin.ft. 12-in. cast-iron gas pipe	1.50	1.90	1.00
115 lin.ft. 16-in. cast-iron gas pipe	2.00	2.25	2.00
100 lin.ft. 18-in. cast-iron gas pipe	2.25	2.40	2.00
120 lin.ft. 20-in. cast-iron gas pipe	2.50	2.50	3.00
100 lin.ft. 24-in. cast-iron gas pipe	3.00	4.50	3.00
7,720 lin.ft. 8-in. by-passing pipe w.-i.	1.30	1.00	2.60
330 lin.ft. 12-in. w.-i. or riveted by-passing pipe	2.50	2.00	2.60
1,350 lin.ft. 16-in. w.-i. or riveted by-passing pipe	2.75	2.00	2.60
215 lin.ft. 20-in. w.-i. or riveted by-passing pipe	3.00	2.00	4.00
60 lin.ft. 24-in. w.-i. or riveted by-passing pipe	3.50	2.00	4.00
150 lin.ft. 30-in. w.-i. or riveted by-passing pipe	4.00	2.00	5.00
810 lin.ft. type "B" cable suspension support by-passing pipe	8.40	12.00	2.00
115 lin.ft. 8-in. w.-i. gas pipe, including all appurtenances	6.00	5.00	4.00
115 lin.ft. 10-in. w.-i. gas pipe, including all appurtenances	8.00	6.00	5.00
70 service connections for gas pipes, all sizes	30.00	30.00	30.00

	A	B	C
167 tons new cast-iron hub and spigot, straight pipe	$120 00	$100 00	$150 00
115 lin.ft. new standard iron fittings for new w.-i. 8-in. gas pipe	6 00	5 00	4 00
115 lin.ft. new standard iron fittings for new w.-i. 10-in. gas pipe	8 00	6 50	5 00
46 tons new cast iron special pipe	215 00	175 00	150 00
115 lbs. new mall. iron fittings for new w.-i. gas pipe	20	20	40
145 lin.ft. 12-in. high pressure fire system water pipe	2 50	4 00	8 00
115 lin.ft. 24-in. high pressure fire system water pipe	5 00	6 00	10 00
14 tons new cast iron spigot and groove, straight pipe	140 00	120 00	160 00
10 tons new cast iron spigot and groove pipe special castings	250 00	235 00	300 00
260 lin.ft. 6-in. air pipe	5 00	1 50	1 00
115 lin.ft. new 6-in. air pipe	8 00	2 00	3 00
4,600 duct ft. electric ducts and conduits in place	50	35	50
175 lin.ft. 2½-in. w.-i. pipe electric ducts	50	75	1 00
3,705 lin.ft. 3-in. w.-i. pipe electric ducts	60	90	1 20
165 lin.ft. 3½-in. w.-i. pipe electric ducts	70	1 05	1 50
1,450 lin.ft. Johnstone 16-way ducts	50	5 00	50
140 service connections for electric ducts	20 00	30 00	30 00
Extended totals	$3,363,974	$3,488,036	$3,677,975

Industrial Works (Continued)

to plant, to include 30 x 36 ft. compressor, 30 x 84 ft. purifier and drier, 24 x 26 ft. garage, 30 x 90 ft. charging, 12 x 16 ft. cylinder repair and 16 x 24 ft. oil trap buildings, 15 x 33 ft. boiler house addition, also alterations and addition to generator and compressor building, concrete, brick and steel, rein.-con. flooring, concrete foundations, on Lincoln and Tabor Sts. About $100,000. Private plans.

Md., Baltimore—Lockwood, Greene & Co., archts. and engrs., 101 Park Ave., New York City, soon let contract building 4 story, 80 x 222 ft., rein.-con., brick and steel factory, rein.-con. flooring, concrete foundation, for McCawley & Co., 400 Exch. Pl. About $650,000. Noted May 6.

Md., Sparrows Point—Bethelem Steel Corp., Bethelem, Pa., plans to enlarge plant here, to include new blast furnaces and addition of 24 miles to present tin plate plant. W. M. Tobias, Bethlehem, ch. engr.

S. C., Greenville—H. Wilkins and others plan to build factory. About $50,000. Architect not selected.

O., Cleveland—Champion Bed Springs Co., 3717 Iron Court, soon lets contract building 2 story, 58 x 172 ft., brick and steel factory, brick foundation, at 6500 Park Ave. J. P. McBeth, pres.

O., Cleveland—G. Paul, 524 Citizens Bldg., plans to build 1 or 3 story, 40,000-80,000 sq.ft., rein.-con., steel and brick factory, rein.-con. flooring, concrete foundation, on Superior Ave. between 49th and East 51st Sts. About $150,000. Private plans.

O., Cleveland—Reynolds Motor Co., 8811 Miles Park Ave., having plans prepared by H T. Jeffrey, archt., Northern Natl. Bank Bldg., for 3 story, 50 x 160 ft., rein.-con., brick and steel garage and sales rooms, rein.-con. flooring, concrete foundation. About $125,000. J. F. Reynolds, mgr.

O., Cleveland—S. H. White, archt., 1032 Schofield Bldg. soon lets contract building 1 story, 60 x 110 ft., rein.-con., brick and steel garage and sales room, rein.-con. flooring, concrete foundation, at 6820 Euclid Ave., for W. D. Sixt, c/o architect. About $75,000.

O., Cleveland—Superior Screen & Bolt Mfg. Co., 810 Hippodrome Bldg., having plans prepared by Realty Dept. of Natl. Lamp Co., archts. and engrs., Nela Park, East Cleveland, for 2 story, 130 x 250 ft., rein.-con., brick and steel factory, rein.-con. flooring, concrete foundation, at 3652 East 93rd St. About $175,000.

O., Garrettsville—McWade Tire & Rubber Co. plan to build 2 story, 30,000 sq.ft. floor space, rein.-con., steel and brick factory, rein.-con. flooring, concrete foundation. About $75,000. Private plans.

O., Toledo—Bock Bearing Co. soon lets contract building 2 story, machine shop, brick and steel, concrete foundation, on Phillip Ave. About $110,000. G. B. Rheinfrauls, 601 Gardner Bldg., archt.

Mich., Bay City—Amer. Worsted Yarn C. having plans prepared by Lockwood & Green, archts. and engrs., 38 South Dearborn St., Chicago, for 4 story, 125 x 400 ft., rein.-con. and steel factory, rein.-con. flooring, concrete foundation, on Water St. About $200,000. Noted April 15.

Mich., Bay City—Wildman Rubber Co., Book Bldg., having plans prepared by Osborn Eng. Co., archts. and engrs., 2848 Prospect Ave., Cleveland, O., for 1 and 3 story, rein.-con., brick and steel factory, rein.-con. flooring, concrete foundation. About $2,000,000. Noted June 10.

Mich., Detroit—F. M. Foster Truck Co., 980 East Jefferson Ave., plans to build 4 or 5 story, 100 x 120 ft., rein.-con., brick and steel service station, rein.-con. flooring, concrete foundation. Private plans.

Mich., Detroit—Kirby Ave. Development Co., care of Smith, Hinchman & Grylls, archts., 710 Washington Arcade, having plans prepared for 2 story, rein.-con., brick and steel garage and service station, rein.-con. flooring, concrete foundation. About $150,000.

Mich., Detroit—Walsh & O'Dell, archts., 1327 Chamber Commerce, preparing plans for 1 story, 100 x 185 ft., brick and steel factory, brick foundation, on 12th St. About $50,000. Owner's name withheld.

Mich., Flint—Standard Oil Co. of Indiana, 910 South Michigan Ave., Chicago, soon lets contract building 2 story, 164 x 232 ft. distributing station, rein.-con., rein.-con. flooring, concrete foundation, to include garage, warehouse, office and tank house. About $200,000. Private plans.

Wis., Racine—S. C. Johnson & Son, 1012 16th St., rejected bids building 4 story, 60 x 160 ft. warehouse and varnish plant, brick and concrete. Work will be readvertised. Noted June 3.

Mo., Kansas City—Tarbett & Sornell, archts., Republic Bldg., soon let contract building 5 story, 100 x 113 ft. brick warehouse and office, rein.-con. flooring, concrete foundation, for Whitaker-Slessner Co. Hendrick & Huff, Interstate Bldg., Kansas City, engrs.

Tex., Bridgeport—Phoenix Clay Corp., 1215 Southwestern Life Bldg., Dallas, recently granted charter with $200,000 capital stock, and plans to build plant here, 125,000 brick or 150 ton tile, daily capacity. C. W. Martin, pres.

Cal., San Pedro—Fabri-Cord Tire Co., 917 Citizens Natl. Bank Bldg., Los Angeles, purchased site and plans to build 1st unit of factory, 3 story, 60 x 250 ft. rein.-con., on 17th St. About $80,000. S. H. Christian, pres. Architect not selected.

Que., Montreal—Natl. Drug Co., St. Lawrence St., soon receives bids building plant in St. Henry Dist. About $175,000.

Que., Three Rivers—Lafleur & McDougall, 107 St. James St., Montreal, interested in company which plans to build steel plant, on Normand Blvd., for which bids will be received. About $750,000.

Ont., Hamilton—Hydro Electric System, City Hall, soon receives bids building steam auxiliary plant, near eastern city limits. A. Jutten, controller.

Ont., Kenora—St. Francis Pulp & Paper Co. soon receives bids building pulp and paper mill, on English River, north of here. About $500,000.

Ont., Windsor—See "Railways"

BIDS DESIRED

N. J., Paterson—McCormick Co., archts. and engrs., Century Bldg., Pittsburgh, receiving bids building 3 story, 140 x 210 ft. bakery and 2 story, 50 x 50 ft. stable, brick and steel, for Sunburst Baking Co., here. About $100,000.

O., Canton—Amer. Roll & Fdry. Co. receiving bids building 1 story, 59 x 140 ft. addition to machine shop, also 2 story, 45 x 80 ft. pattern shop, brick and steel. United Eng. & Fdry. Co., Farm Bank Bldg., Pittsburgh, Pa., engrs.

Ind., West Hammond—R. G. Pierce, archt., 10 South La Salle St., Chicago, receiving bids building 1 story, 210 x 560 ft., steel and brick plant, concrete foundation, for La Salle Iron Wks., 2305 South Halsted St., Chicago. About $650,000. N. Ronneberg, 10 South La Salle St., Chicago, engr.

Wis., Eau Claire—Standard Oil Co., of Indiana, 910 South Michigan Ave., Chicago, receiving bids building 1 and 2 story, 30 x 200 ft. distributing station, brick and steel, concrete foundation, to include warehouse, garage, barrel house, tank, office, etc. About $150,000. Private plans.

Wis., Milwaukee—Until June 29, by Comr. Pub. Wks., building 1 story, 50 x 120 ft., meter shop, rein.-con., brick and steel, rein.-con. flooring, concrete foundation, on Market St. About $60,000. C. E. Malig, City Hall., archt.

Wis., Port Washington—Until June 28, by Turner Mfg. Co., building addition to factory, also 1 story, 150 x 160 ft. rein.-con., brick and steel foundry, rein.-con flooring. F. O. Chase, Inc., 645 North Michigan Ave., Chicago, archt.

Neb., Grand Island—Tieter & Homair receiving bids building 4 story, 66 x 132 ft. rein.-con., brick and steel garage and service station, rein.-con. flooring, concrete foundation. About $80,000. G. W Graves, 43 John R St., Detroit, archt. Noted April 1.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

★Vt., Brattleboro—C. F. Church Mfg. Co., Willimansett, Mass., let contract constructing 1 story plant, 1 story dry kiln building and 1 story boiler house, brick and steel, here, to E. F. Carlson Co., 244 Main St., Springfield, Mass. About $80,000.

★Mass., Cambridge—Standard Plate Glass Co., 30 Sudbury St., Boston, let contract building 4 story, 100 x 200 ft. plant, on Albany St., to W. H. and H. A. Root, 6 Beacon St., Boston; cost plus percentage basis.

★Mass., Chelsea (Boston P. O.)—H. H. Atwood, archt., 61 Alban St., Dorchester, let contract to J. Slotnick, 448 Bway., altering and building 2 story, 35 x 90 ft. brick and steel power plant and laundry addition, rein.-con. flooring, concrete foundation, at Soldiers' Home, here, for Commonwealth of Massachusetts, Boston. About $125,000. Noted June 10.

★Mass., Gardner—Amer. Fibre Corp. let contract building 1 story, brick and steel factory, rein.-con. flooring, concrete foundation, on Coleman St., to N. E. Frissell, Gardner. About $75,000.

★Mass., Quincy (Boston P. O.)—P. S. Yerxa, 1452 Hancock St., let contract building 1 story, 70 x 100 ft., brick and concrete garage, concrete flooring and foundation, on School St., to C. C. Temple Co., 40 Court St., Boston. About $50,000.

★Mass., Springfield—McClintock & Craig, archts. and engrs., 33 Lyman St., let contract to E. J. Pinney, Inc., 274 Main St., building 3 story, 60 x 132 ft., brick, concrete and steel addition to plant, rein.-con. flooring, concrete foundation, for Bausch Tool Co., 156 Wason Ave. About $75,000. Noted June 10.

★Mass., Woburn—Cambridge Paper Box Co., 196 Bway., let contract building 2 story frame addition to plant, concrete foundation, to A. J. Moore, 9 Fletcher Rd. About $50,000.

★Conn., New London—U. S. Electric Co., 108 State St., let contract building 75 x 101 ft., rein.-con. foundry, rein.-con. flooring, concrete foundation, at foot of Trumbull St., to H. T. Jackson & Co., 108 State St. About $50,000.

★N. Y., Brooklyn—S. Ageloff, 126 Reid Ave., will build 1 story, 200 x 256 ft., brick and steel garage, rein.-con. flooring, concrete foundation, at 283 4th Ave. About $200,000. Work will be done by day labor under supervision of Shampan & Shampan, 50 Court St., archts. Noted June 17.

★N. Y. Brooklyn—W. Nevin, 44 Court St., will build 2 story, 100 x 107 ft., brick and steel garage, rein.-con. flooring, concrete foundation, on Waverly and Fulton Sts. About $130,000. Work will be done by day labor.

★N. Y., Brooklyn—S and R Holding Co., 175 Bay 29th St., will build 1 story, 100 x 173 ft., brick and steel garage, rein.-con. flooring, concrete foundation, on Gold and Prospect Sts. About $150,000. Work will be done by day labor.

★N. Y., Long Island City—Olga Realty Co., care of Shampan & Shampan, archts., 50 Court St., Brooklyn, will build 100 x 125 ft., brick and steel factory, rein.-con. flooring, concrete foundation, on Vernon Ave. near Freeman Ave. About $50,000. Work will be done by day labor under supervision of architects.

★N. Y., New York—Federal Reserve Bank, 15 Nassau St., let contract building 63 x 72 ft., rein.-con., brick and steel storage plant, rein.-con. flooring, concrete foundation, on Maiden Lane and Gold St., to M. Eidlitz, 30 West 42nd St. About $350,000.

★N. Y., New York—L. Gold, 44 Court St., Brooklyn, will build 5 story, 100 x 100 ft., rein.-con. and steel garage and service station, rein.-con. flooring, concrete foundation, at 529 West 55th St. About $350,000. Work will be done by day labor.

★Pa., Phila.—Curtis Publishing Co., Independence Sq., let contract building 1 story addition to top of plant, concrete and brick, to Doyle & Co., 1519 Sansom St. About $600,000.

Industrial Works (Continued)

★Va., Richmond—Standard Paper Mfg. Co., Hull and Canal Sts., let contract building rein.-con., steel and brick mill, rein.-con. flooring, concrete foundation, on Canal St., to Wise Granite Constr. Co., Amer. Natl. Bank Bldg. About $150,000.

★O., Cleveland—Newburgh & South Shore R.R., Jones Rd., let contract building 1 story, 113 x 260 ft., rein.-con., steel and brick car shops, rein.-con. flooring, concrete foundation, on East 71st St. and Park Ave., to F. W. Mark Constr. Co., Leader-News Bldg. About $110,000.

★O., Geneva—Amer. Fork & Hoe Co., Swetland Bldg., Cleveland, let contract building 1 story, 55 x 260 ft., rein.-con., steel and brick factory, rein.-con. flooring, concrete foundation, to Rice-Jones Co., 10,600 Euclid Ave., Cleveland. About $100,000.

★O., Massillon—Alloy Electric Steel Castings Co. let contract building 1 story, 50 x 150 ft., brick and steel mill, brick foundation, to Boldt Constr. Co., 6110 Euclid Ave., Cleveland. About $60,000.

★O., Ravenna—Cleveland Worsted Mills Co., 6140 Bway., let contract building 4 story, 50 x 150 ft., brick and steel addition to factory, brick foundation, to P. L. Frank Constr. Co., Ravenna. About $100,000.

★O., Warren—Frost Superior Fence Co., East 131st St., Cleveland, let contract building 1 story, 60 x 220 ft., concrete, brick and steel factory, rein.-con. flooring, concrete foundation, on Kinsman Tract, here, to H. K. Ferguson, Vickers Bldg., Cleveland. About $100,000.

★Mich., Battle Creek—Montgomery Motor Sales Co. let contract building garage, to M. J. Morehouse, 343 South Dearborn St., Chicago. About $100,000.

★Mich., Detroit—Dodge Bros., Jos. Campau Ave., let steel contract for 100 x 100 ft. power house, to Russel Wheel & Fdry. Co., Chene St., and Belt Line Ry. Total cost, $2,000,000. Noted May 20.

★Mich., Detroit—International Metal Stamping Co., Artillery and Muster Aves., let contract building 1 story 79 x 532 ft. addition to factory, rein.-con., brick and steel, rein.-con. flooring, concrete foundation, to H. G. Christman Co., 315 Stevens Bldg. About $130,000. Noted June 10.

★Mich., Detroit—Sun Oil Co., Woodville St. and Belt Ry., Toledo, O., let contract building 2 story, 80 x 80 ft., rein.-con. warehouse, concrete foundation, here, to A. Bently & Sons., 201 Belmont Ave., Toledo, O. About $100,000.

★Mich., River Rouge—Amer. Gypsum Co., Port Clinton, O., will build rein.-con. and steel, storage and handling plant, rein.-con. flooring, concrete foundation, with concrete coal pockets and 145 ft. rein.-con. tunnel, here. About $75,000. Work will be done by day labor. Noted April 29.

★Wis., Fond du Lac—Bulldog Tractor Co. let contract building 1 story, 60 x 300 ft. monitor type factory, to Immel Constr. Co., 200 North Main St.

★Wis., Sheboygan—Sheybogan Lime Wks., 822 Niagara Ave., let contract building 2 story, 48 x 143 ft. garage, office and display room, rein.-con., brick and steel, rein.-con. flooring, brick foundation, on South Water St., to Lemke & Hilpertshauser, Sheboygan. Noted June 10.

Buildings

PROPOSED WORK

Mass., Athol—Hall—Town having preliminary plans prepared by Brainerd, Leeds, Kellogg and Thayer, archts., 89 Franklin St., Boston, for 2 story, 50 x 125 ft. memorial hall and auditorium (1,500 seating capacity). About $100,000.

Mass., Boston—Bank—Workingmen's Cooperate Bank, 101 Tremont St., having plans prepared by T. M. James, archt., 3 Park St., for brick and concrete, on Cornhill St.

Mass., Boston—Bathhouse, etc.—City plans to build bathhouse and headhouse at Marine Park. About $150,000.

Mass., Boston—Office and Bank—Federal Trust Co., 85 Devonshire St., having plans prepared by McLaughlin & Burr, archts., 88 Tremont St., for 10 story, 24 x 72 ft., brick, rein.-con. and steel, on Washington St. J. H. Worcester, 79 Milk St., Boston, engr.

Mass., Cambridge—Memorial—Trustees Harvard University having plans prepared by Coolidge & Shattuck, archts., 122 Ames Bldg., Boston, for large memorial building, on Huntington Ave.

Mass., Chicopee—Church—St. Joachim Roman Catholic Society, 202 Main St., having plans prepared by J. W. Donahue, archt., 496 Main St., Springfield, converting present church on Main and Maple Sts. into school and building new brick and stone church. About $150,000. G. H. Gagnon, pastor.

Mass., Holyoke—Theatre—J. H. Baker, 269 Maple St., having plans prepared by G. P. B. Alderman & Bro., archts., Alderman Bldg., for 3 story, brick, concrete and steel. About $200,000.

Mass., Lawrence—Parish—Grace Episcopal Society, Jackson and Gardner Sts., having plans prepared by Peare, Nevin, Quinn & Chickering, archts., 6 Beacon St., Boston, for 2 story, 50 x 100 ft., on Garden St. About $100,000.

Mass., Longmeadow (Springfield P. O.)—Community—Congregational Society of Longmeaddow having plans prepared by Smith & Bassette, archts., 36 Pearl St., Hartford, Conn., for 3 story, wood and stucco, on Longmeadow St. About $100,000.

Mass., Mattapan (Boston P. O.)—Dining Room—Commonwealth of Massachusetts, Comn. of Mental Diseases, 36 State House, Boston, had plans prepared by Kendall, Taylor & Co., archts. and engrs., 93 Federal St., Boston, for 2 story, brick and concrete, rein.-con. flooring, concrete foundation (west group), at State Hospital, here. About $200,000.

Mass., Mattapan (Boston P. O.)—Nurses' Home—Commonwealth of Massachusetts, Mental Disease Comn., 36 State House, Boston, soon receives bids building 2 story, brick, concrete and steel, rein.-con. flooring, concrete foundation, at east group of State Hospital, here. About $125,000. Kendall, Taylor & Co., 93 Federal St., Boston, archts. and engrs.

R. I., Arctic—Theatre—H. P. Groves, archt., 44 Middlesex St., Lowell, Mass., soon lets contract building 2 story, 70 x 140 ft., brick, steel and timber, concrete foundation, here, for Black-Spitz Theatres, Inc., Taunton, Mass. About $150,000.

R. I., Kingston—High School—School Bd. having plans prepared by F. I. Cooper Corp., archts., 33 Cornhill St., Boston, Mass., for 2 story, 80 x 130 ft.

R. I., Providence—School—City soon lets contract building 3 story, 40 x 40 ft., brick and steel, concrete foundation, on Nelson and Jastram Aves. About $100,000. Private plans.

Conn., New London—Hospital—D. S. Donnelly, archt., Plant Bldg., soon receives bids building 4 story, 50 x 86 ft., brick and concrete addition, rein.-con. flooring, concrete foundation, on Ocean Ave., for Lawrence Memorial Hospital. About $100,000. Noted April 22.

Conn., Windsor—High School—School Com. having plans prepared by Whiton & McMahon, archts., 36 Pearl St., Hartford, for 3 story, brick, concrete and steel, on Main St. About $200,000. Noted April 1.

N. Y., New York—Hotel—Hotel Des Artistes, 1 West 67th St., soon receives bids altering brick and stone. About $100,000. Starrett & Van Vleck, 8 West 40th St., archts. and engrs.

N. Y., New York—Office—Pitt & Scott, 60 Pearl St., having plans prepared by E. Schneider, archt. and engr., 29 Alberters Ave., Corona, for 5 story, 25 x 85 ft., brick, steel and stone, concrete foundation, at 55 Front St.

N. Y., Schenectady—Theatres—D. J. Bondy, 82 Wall St., New York City, having sketches made by De Rosa & Pereira, archts. and engrs., 110 West 40th St., New York City, for two brick and stone, brick and concrete foundations, here. About $400,000.

N. J. Newark—Recreation—J. H. and W. C. Ely, archts. and engrs, Firemans Trust Bldg. receive bids about July 1, building 4 story, 140 x 200 ft. brick and concrete, on Clark and Ogden Sts., for Clark Thread Co. About $350,000.

Pa., Phila.—Theatre and Office—Stanley Co. of Amer., 1214 Market St., having plans prepared by Hoffman & Henon, archts., Finance Bldg., for 16 story concrete, brick and steel, on Market and 11th Sts. About $1,000,000.

Pa., Pittsburgh—Theatre—Famous Players Corp., 485 5th Ave., New York City, had plans prepared by H. E. Kennedy, archt., Pittsburgh, for 169 x 180 ft., on East Liberty St. About $750,000.

Pa., Plainsville—School—Bd. Educ. plans to build 3 story, 40 x 110 ft., concrete, brick and stone, brick foundation, on South Main St. About $100,000. Architect not selected.

Pa., Pocono—Hotel—Price Bros. plan to build 3 story, 100 x 100 ft., brick, steel and stone, rock foundation, on Pocono Highway. About $160,000. Architect not selected.

Pa., Scranton—Church—First Christian Church plans to build 2 story, 50 x 150 ft., concrete, brick and marble, rock foundation, on North Main Ave. About $100,000. L. M. Davis, 905 Wood St., archt.

Pa., Scranton—Court House—Lackawanna Co. having plans prepared by J. Nelson, archt., Connell Bldg., for remodeling 2 story, brick, marble, stone and granite, on Courthouse Sq. About $200,000.

Pa., Sugar Notch (Wilkes-Barre P. O.)—High School—Boro plans to build 3 story, 50 x 100 ft. brick and steel, rock foundation, on Main St. About $110,000. Architect not selected.

Pa., Wilkes-Barre—Convent—St. Mary's Catholic Church, 161 South Washington St., plans to build 3 story, 50 x 100 ft., concrete, brick and stone addition. About $100,000. G. F. Schroeder and C. Schmitt, Wiltenkorn Bldg., archts. Noted June 22.

Pa., Wilkes-Barre—Parish House—St. Stephens Episcopal Church plans to build 3 story, 60 x 100 ft., brick, steel and stone, on South Franklin St. About $160,000. Architect not selected.

N. J., Ridgefield Park (Hackensack P. O.)—School—Bd. Educ. purchased site and plans to build modern school. About $245,000.

Pa., Bangor—High School—School Dist. having plans prepared by Rasmussen & Wayland, archts. and engrs., 252 West 46th St., New York City, for 2 story brick and stone, brick foundation. About $125,000. E. Flory, pres.

Pa., Beaver Falls—School—Bd. Educ. rejected bids received May 28, building 2 story, 60 x 132 ft., rein.-con., brick and steel, rein.-con. flooring, brick foundation. About $160,000. Project abandoned. Noted May 20.

Pa., Elmhurst—Asylum—St. Nicholas Greek Catholic Church of Amer. plans to build 3 story, 100 x 250 ft., brick, steel, marble and stone, rein.-con. flooring, rock foundation, on Elmhurst Ave. About $300,000. Architect not selected.

Pa., Orphanage (Sunbury P. O.)—Asylum—Independent Order Odd Fellows Orphanage having plans prepared by W. H. Lee, archt. and engr., 32 South 17th St., Phila., for 3 story, 45 x 55 ft., concrete and brick addition. About $100,000.

Pa., Phila.—Auditorium—Progress Club, 1417 Diamond St., having plans prepared by H. C. Hodgens, archt., 130 South 15th St., for 1 story, 50 x 100 ft., concrete and brick, on 15th and Diamond Sts.

Pa., Phila.—Church—Holy Spirit Catholic Congregation had plans prepared by R. A. Schuman, archt., 932 Lamberton St., Trenton, for church. About $150,000.

Pa., Philadelphia—Loft—A. J. Sauer, archt. and engr., Denckla Bldg., rejected bids building 6 story, 45 x 112 ft., concrete and brick, on 13th and Florist Sts. Owner's name withheld. Project abandoned. Noted March 4.

Pa., Phila.—Synagogue—Tikvas Israel Congregation, c/o E. L. Rothchild, archt., Penfield Bldg., having plans prepared for 3 story, 55 x 115 ft., brick and stone, on 41st and Parkside Sts. Cost to exceed $100,000.

Md., Baltimore—Office—W. G. Nolting, archt., 1012 Keyser Bldg., revising plans and soon receives bids constructing 3 story (ultimately 12 story), steel, brick and stone, concrete foundation, on Calvert and Mercer Sts., for United States Fidelity & Guaranty Co., Calvert and Redwood Sts. New building to be connected with present building by tunnel under Mercer St. About $300,000. Noted Jan. 22.

Md., Baltimore—High School—City having plans prepared by E. H. Glidden, archt., Amer. Bldg., for 3 story, 100 x 500 ft., steel and brick, rein.-con. flooring, rock foundation, on Poplar Grove St. About $600,000.

Va., Danville—School—Randolph—Macon Institute, having plans prepared by E. R. James, archt., Danville, for fireproof building, to include dining hall, auditorium and dormitory. About $300,000. C. G. Evans pres.

Va., Danville—Temple—Masonic Bldg. Corp. having plans prepared by F. F. Faris, archt., Schmulbach Bldg., Wheeling, W. Va., for 10 story, fireproof. About $600,000. Noted Feb. 12.

Va., Schoolfield—School and Community—Dan River & Riverside Cotton Mills, Danville, Va., having plans prepared by E. R. James, archt., Danville, for 3 story brick. About $150,000.

W. Va., Chattaroy—High School—City approved $100,000 bond issue to build school.

W. Va., Glenville—Courthouse—Gilmer Co. soon receives bids building 2 story, 65 x 100 ft., brick and limestone. About $125,000. Wysong, Tufts & Jones, Charleston, archts.

N. C., Greensboro—Church—First Presbyterian Church plans to build new church. About $250,000. C. F. Myles, pastor.

N. C., Greensboro—Office—Jefferson Standard Life Insurance Co. having plans prepared by C. C. Hartmann, archt. Greensboro, for 12-15 story, on 115 x 147 ft. site. Cost between $1,000,000 and $1,500,000. J. Price, pres.

Ky., Winchester—School—Clark Co. Bd. Educ. receives bids about September or October, building 1 story, 162 x 106 ft.

Buildings (Continued)

brick, concrete, tile and steel, wood flooring. About $110,000. J. W. Crone & Son, Brown Procteria Bldg., archts.

O., Akron—City Hall—City plans to issue $900,000 bonds to build city hall.

O., Cleveland—Commercial—M. Marmorstein, 1604 Williamson Bldg., plans to build 1 story concrete, brick and steel, rein.-con. flooring, concrete foundation, at 2536 Euclid Ave. About $100,000. Architect not selected.

O., Cleveland—Dormitory—J. P. Farrelly, East 9th St. and Euclid Ave., plans to build 3 or 4 story rein.-con., steel and brick, rein.-con. flooring, concrete foundation, at University Circle. About $200,000. Architect not selected.

O., Cleveland — Sales — See "Industrial Works."

O., Cleveland—Schools—Bd. Educ., East 6th St. and Rockwell Ave., plans to build 1 story, 30 room, on Sandusky Ave., also 1 story, 16 room, on Lake Ave., both rein.-con., brick and steel, rein.-con. flooring, concrete foundation. Cost $1,000,000 and $500,000 respectively. W. R. McCornack, East 6th St. and Rockwell Ave., archt.

O., Cleveland—Schools—City election Nov. 2 to vote on $1,000,000 bonds to build 1 story, 30 room, on Harvard and East 146th Sts.; $750,000 for 3 story, on Parkview and Mt. Auburn Sts., and $1,000,000 for 1 story, 30 room, on East Woodland and East 128th Sts., rein.-con., brick and steel, rein.-con. flooring, concrete foundations. F. G. Hogan, dir. W. R. McCormack, East 6th St. and Rockwell Ave., archt.

O., Columbus—Schools—Bd. Educ. plans to build Central Technical High School, cost $1,000,000, North High School, $1,100,000, East High School, $800,000, South High School, $800,000. Lincoln Park High School, $265,000 and 4 elementary schools, $250,000 each. D. Riebel & Sons, New 1st Natl. Bank Bldg., archts.

O., Ravenna — Office — Natl. Furnace & Stove Co. having plans prepared by D. C. Smith, archt. and engr., 4,500 Euclid Ave., Cleveland, for 1 story, 80 x 220 ft. office and foundry, steel and brick, brick foundation. About $125,000. M. Kinsman, mgr.

Mich., Detroit—Mercantile—J. G. Kastler & Co., archts., 523 Chamber of Commerce, preparing plans for 4 story, 67 x 100 ft., rein.-con., brick and steel, concrete foundation, on Martin and Michigan Aves. About $100,000. Owners name withheld.

Mich., Eloise—Dormitory—Wayne Co., Poor Bd., c/o O. P. Gulley, 27 Churchill St., Detroit, having preliminary plans prepared by MacFarlane, Maul & Lentz, archts., 1257 David Whitney Bldg., Detroit, for 2 story, rein.-con., brick and steel, rein.-con. flooring, concrete foundation, (to be 1st unit of hospital and home). About $200,000. Noted April 15 under "Hospital and Home."

Mich., Pontiac—Church—Bethany Baptist Congregation soon lets contract building 1 and 2 story, 75 x 100 ft., brick, steel and stone, brick foundation, on Lincoln and West Huron Aves. About $100,000. Stahl & Kinsey, 435 Woodward Ave., Detroit, archts.

Mich., Saginaw — Bank and Office — Weary & Alford, archts., 1732 South Michigan Ave., Chicago, receive bids about July 1, building 16 story, 120 x 120 ft., rein.-con., brick and tera cotta, rein.-con. flooring, concrete foundation, for 2nd Natl. Bank, 110 North Washington St. About $2,250,000.

Wis., Appleton—Hospital—St. Elizabeths Hospital having plans prepared by V. J. Klutho, archt., Syndicate Trust Bldg., St. Louis, for 4 story, rein.-con. and brick, rein.-con. flooring, concrete foundation. About $500,000. Noted June 17.

Wis., Manitowoc—Church — Presbyterian Congregation having preliminary plans prepared by Juul & Smith, archts., Imig Bldg., Sheboygan, for 2 story, 42 x 142 ft., rein.-con., brick and steel, brick foundation, on Meadow Lane.

Wis., Marshfield — Bank — Amer. Natl. Bank plans to build 1 story, 44 x 100 ft. bank. About $100,000. Oppenhauer & Obel, archts.

Wis., Sheboygan — High School — Bd. Educ. receives bids about July 15, building 3 story, 270 x 300 ft., rein.-con. brick and steel, brick foundation, on Jefferson and 9th Sts. About $750,000. Childs-Smith, Van Buren St., Chicago, archts.

Wis., Stevens Point—Church—St. Stephens Catholic Church plans to build 50 x 136 ft. stone and timber, concrete foundation. About $100,000. Childs & Smith, 64 East Van Buren St., Chicago, archts.

Wis., Union Grove—Refectory and Dormitories—State Bd. Control, Madison, had plans prepared by A. R. Peabody, archt., Madison, for refectory, cost $50,000 and four 2 story, 40 x 150 ft. dormitories, $90,000 each. J. M. Tappins, secy.

Wis., West Bend—Office, etc.—West Bend Heating & Light Co. plans to build 4 story, rein.-con., brick and steel, rein.-con. flooring, brick foundation, on E. Main St. About $100,000. Architect not selected.

Ia., Cosgrove (Oxford P. O.)—School—Bd. Educ. plans to build school. About $100,000. Architect not selected.

Ia., Jolley—School—Bd. Educ. having plans prepared by Martin & Sutherland, archts., Storm Lake, building 2 story, 64 x 90 ft., rein.-con., brick and steel, rein.-con. flooring, concrete foundation. About $100,000.

Minn., Sleepy Eye — School — Bd. Educ. having plans prepared by K. T. Snyder, archt., 739 Plymouth Bldg., Minneapolis, for remodeling 2 story, 80 x 160 ft., and building 64 x 90 ft. addition in rear, mill construction. About $100,000. T. E. Lewis, supt.

S. D., Sioux Falls—Y. M. C. A. soon lets contract building 5 story, 131 x 151 ft., rein.-con., brick and steel, rein.-con. flooring, concrete foundation. About $350,000. Perkins & McWayne, 322 Palton St., archts.

N. D., Bismarck — Memorial — State Bd. Administration soon lets contract building 3 story, 61 x 100 ft., Bedford limestone front, on Capitol grounds. About $200,000. Keith & Kurke, Bismarck, archts. Noted March 18.

N. D., Jamestown—High School—Bd. Educ. having plans prepared by Shannon, Boyd & Boyd, archts., Jamestown, for 3 story, 230 x 240 ft., 28 room. About $200,000.

Mo., Kansas City—Hospital—Owner c/o A. C. Stowell, 2011 East 11th St., having sketches made by Keen & Simpson, archts., Reliance Bldg., for 5 or 6 story hospital.

Mo., Kansas City—Office—See "Industrial Works"

Mo., Nevada—Hospital—State Hospital 3 having plans prepared by Hawkins & Hoener, archts., Holland Bldg., Springfield, for 3 story, rein.-con., brick and steel. About $100,000.

Tex., Corsicana—Schools—City voted $600,000 bonds to build schools. J. E. Blair, supt. schools.

Tex., San Antonio — Auditorium — City plans to build 1 story, rein.-con. and steel, concrete foundation, on Komano and Navarro Sts. About $500,000.

Okla., Henryetta—Theatre—S. Petropakus having plans prepared by Smith, Rea, Lovitt & Center, archts., Parkinson Bldg., Okmulgee, for 2 story, 50 x 140 ft., rein.-con., brick and steel, rein.-con. flooring, concrete foundation.. About $110,000.

Wash., Seattle — Theatre — Clemmer & James, Amer. Bank Bldg., having plans prepared by F. H. Fowler, archt., L. C. Smith Bldg., for 1 story, 60 x 108 ft. fireproof, at 1515 3rd Ave. About $200,000.

Cal., Long Beach—Schools—City voted $125,000 bonds to construct addition to Daisy Ave. School, $50,000 for arts buildng at high school, $75,000 for equipment and $50,000 to purchase sites. Architect not selected.

Cal., Los Angeles—Church—First Church of Los Angeles plans to build 3 story, 100 x 200 ft., steel, marble, granite and stone. About $1,000,000. Architect not selected.

Cal., Los Angeles—Schools—City voted $6,000,000 bonds to purchase sites, build and equip grammar schools and $3,500,000 for high schools.

Cal., Pasadena—Schools—City defeated $4,500,000 bond issue to build schools. Noted March 25.

Que., St. Anne de Monts — Church — Roman Catholic Congregation soon receives bids building church, brick, steel and stone. About $160,000. A. Boivert, pastor.

Que., Montreal—Church—St. Gertrude Congregation, Sault au Recollet, soon lets contract building 55 x 80 ft., brick, steel and stone, concrete foundation, on Gouin Blvd., here. About $120,000. A. Chausse, 72 Notre Dame St., E., archt.

Que., St. Lambert—Fire Station and Hall, etc.—Town Council soon receives bids building 3 story, brick, steel and stone. About $100,000. E. Drinkwater, engr.

Ont., Ottawa—Bible House—Ottawa Bible Society soon receives bids building bible house, to include offices, society rooms, printing house, etc. About $150,000. W. H. Crawford, dist., secy.

Ont., Toronto—Churches—Toronto Methodist Union plans to repair Queen St. Church, also build three 1 story, concrete, brick and steel, rein.-con. flooring, concrete foundations, on Dowse Rd., Fairlawn and Bedford Park Aves. About $150,000. S. W. Dean, 141 Jarvis St., secy. Architect not selected.

BIDS DESIRED

Mass., Belchertown — Dormitory, etc. — Until June 29, by Commonwealth of Massachusetts, Comn. on Mental Diseases, 36 State House, Boston, constructing 2 story, 90 x 117 ft., brick and rein.-con. dormitory and custodial building, rein.-con. flooring, concrete foundation, at State Hospital, here. About $250,000. Kendall, Taylor & Co., 93 Federal St., Boston, archts. and engrs.

Conn., Hartford—School—Until July 1, by Northwest School Dist., building 2 story, 90 x 180 ft. with 55 x 90 ft. ell, brick, concrete and steel, rein.-con. flooring, concrete foundation, on Holcomb St. About $235,000. Ford, Buck & Sheldon, 60 Prospect St., archts. Noted May 13.

N. J., West New York—School—Until June 30, by Bd. Educ., at P. S. 5, Hudson Ave. and 10th St., building new school on site of present School No. 1, Madison, 18th and Polk Sts. Cost to exceed $100,000.

O., Warren—Schools—Until July 7, by R. D. Kepner, clk. Trumbull Co., furnishing labor and material constructing 2 Junior High School buildings. Bids will be received on any or all following items, (1) excavating, masonry work and cut stone work, fireproofing, concrete and cement work, (2) lathing and plastering, (3) steel and iron work, (4) carpentry work and hardware (5) glass and glazing, (6) metal work and roofing, (7) painting and varnishing, (8) electric wiring, (9) plumbing and sewers and (10) heating and ventilating.

Mich., Flint—Theatre—Until June 28, by Van Leyen, Schilling, Keough & Reynolds, archts., Cass Ave., Detroit, building 2 story, 40 x 130 ft., rein.-con., brick and steel, rein.-con. flooring, concrete foundation, on Detroit St., for Colonial Theatre Co., c/o architects. About $100,000. Noted March 18.

Ill., Chicago—Office—Holabird & Roche, archts., 104 South Michigan Ave., receiving bids building 2 story, 38 x 110 ft., steel and brick addition, concrete foundation, at 161 North Dearborn St., for Oliver Typewriter Co., 167 North Dearborn St. About $130,000.

Ia., Killduff—School—Until July 5, by Bd. Educ., building 2 story, 57 x 84 ft. rein.-con., brick and steel, rein.-con. flooring, concrete foundation. About $100,000. W. E. Hulse & Co., 309 Securities Bldg., Des Moines, archts.

Ia., Liberty Center—School—Until July 25, by Bd. Educ., building 2 story, 54 x 70 ft., rein.-con., brick and steel, rein.-con. flooring, concrete foundation. About $100,000. W. E. Hulse & Co., 309 Securities Bldg., Des Moines, archt.

Ia., Mapleton—School—Until June 30, by Roman Catholic Congregation, building 2 story, 60 x 80 ft., rein.-con., brick and steel, concrete foundation. About $100,000. W. S. Steele, United Bank Bldg., Sioux City, archt. Noted June 17.

Ia., McCallsburg—School—Until July 1, by Bd. Educ., building 2 story, 79 x 103 ft., rein.-con., brick and steel, rein.-con. flooring, concrete foundation. About $130,000. W. L. Pedicord, Iowa Falls, archt.

Minn., Buhl—School—Until June 28, by Bd. Educ. building 3 story, 180 x 200 ft., rein.-con., brick and steel addition, rein.-con. flooring, concrete foundation, on Main St. About $350,000. L. Ruchstadt, clk. A W. Kerr & Co., Chestnut St., Virginia, engrs. and archts.

Kan., Hiawatha — Auditorium — Until June 28, by city, building 1 story, 81 x 126 ft., rein.-con., brick and steel, rein.-con. flooring, concrete foundation. About $135,000. T. W. Williamson & Co., 418 Central Natl. Bank Bldg., Topeka, archts. Noted June 10.

Kan., Parsons—School—Until June 30, by Bd. Educ., building 2 story, 40 x 190 ft., rein.-con., brick and steel, rein.-con flooring, concrete foundation. About $175,000. T. W. Williamson & Co., 418 Central Natl. Bank Bldg., Topeka, archts. Noted June 3.

Mo., Camden Point—School—Until July 5, by Bd. Educ., furnishing labor and material for 2 story, 33 x 110 ft. school. J. H. Felt & Co., Grand Ave. Temple, Kansas City, archts.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

★**Me., Old Town**—School—Town Impvt. Comn. let contract building 2 story, brick and steel, concrete foundation, to O. Nelson Co., 194 Exchange St., Bangor. About $100,000.

★**Mass., Belmont** (Boston P. O.)—School—School Com. let contract building 2 story, 60 x 70 ft., brick and terra cotta addition, to Payson Park School, rein.-con. flooring, concrete foundation, to J. F. Griffin Co., 17 Milk St., Boston, $104,748.

★**Mass., Milton** (Boston P. O.) — Exchange—New England Telephone & Telegraph Co., 50 Oliver St., Boston let contract building 2 story, 51 x 166 ft., brick, rein.-con. and steel, rein.-con. flooring, concrete foundation, on Adams St., here, to L. D. Willicut & Sons Co., 146 Sumner St., Boston.

Buildings (Continued)

★Mass., Whitinsville — Housing—Whitin Machine Wks. let contract building seventy-five 2 story brick and timber houses for workmen, concrete foundations, to Foundation Co., 233 Bway., New York City. About $850,000.

★R. I., Newport—School—School Comn. let contract rebuilding 3 story, 90 x 150 ft., brick and stone, rein.-con. flooring, on Bway., to M. A. McCormick, 137 Bellevue Ave. About $115,000. Noted June 17.

★Conn., Hartford — Housing — Hartford Home Bldg. Assn. let contract constructing 40 brick and frame houses on Hillside Ave., Zion, Pembroke and Catherine Sts., to T. J. Desmond Co., 31 Nassau St., New York City. About $600,000.

★Conn., Torrington—Church—J. A. Jackson, archt., 1133 Bway., New York City, let contract to L. Longhi & Bro., 43 Center St., building 1 story, brick and stone, concrete and wood flooring, on Union St., for St. Mary Polish Society. About $125,000. Noted March 4.

★N. Y., Brooklyn—School—Bd. Educ. let contract building P. S. 185, brick, steel and stone, concrete foundation, on Ridge Blvd. and 86th St., to J. MacArthur & Co., 22 Ormond Pl., Brooklyn. About $650,000.

★N. Y., Jamestown—Recreation—Cleveland Worsted Mills Co., 6140 Bway., Cleveland, O., let contract constructing 4 story, 60 x 120 ft., brick, concrete and steel, rein.-con. flooring, concrete foundation, here, to Jamestown Constr. Co., 60 River St. About $150,000.

★N. Y., Little Falls—School—Bd. Educ. let contract building brick, steel and stone, brick foundation, to J. Halliman, 1 West Main St. About $125,000. Noted April 29.

★N. Y., New York—Loft—Lerner Realty Co., c/o Shampan & Shampan, archts., 50 Court St., Brooklyn, will alter 6 story brick and stone, at 220 West 29th St. About $100,000. Work will be done by day labor under supervision of architects.

★N. Y., New York—Stores—F. W. Woolworth Co., 233 Bway., will build 1 story, 100 x 125 ft., brick, stone and steel, brick foundation, at 1360 5th Ave. About $100,000. Work will be done by day labor.

★N. J., Atlantic City—Hotel—Ritz-Carlton-Linnard Co., c/o Warren & Wetmore, archts. and engrs., 10 East 47th St., New York City, let contract building 130 x 310 ft., brick, steel and stone, concrete foundation, on Illinois Ave. and Boardwalk, to Thompson-Starrett, 49 Wall St., New York City. About $2,000,000.

★N. J., Newark—Schools—Bd. Educ. let contract building 3 story, 70 x 80 ft. addition, concrete and brick, Alexander St., to D. W. McGee, 142 1st St., $323,763; 3 story, 219 x 222 ft. vocational school, concrete and brick, on 1st and 2nd Sts., to F. Kilgus, 13 South 6th St., $798,800. Noted May 20.

★Pa., Donora — School — Bd. Educ. let contract building 3 story, 120 x 120 ft., brick and steel, to Donora Lumber Co., Donora, $135,290. Noted May 20.

★Pa., Indiana—School—Boro. School Bd. let contract building 3 story, 100 x 115 ft., rein.-con., brick, steel and stone, in 3rd Ward, to Powell & Justus, Punxsutawney. About $100,000.

★Md., Baltimore—Capital Theatre Co., 719 Fidelity Bldg., let contract building 2 story, 120 x 200 ft., concrete, steel and brick, concrete foundation, at 1518-1522 West Baltimore St., to J. H. Miller, Inc., Eutaw and Franklin Sts. About $250,000. Incorrectly noted in our issue of May 27.

★Va., Danville—Housing—Dan River & Riverside Cotton Mills let contract building 50 frame and stucco houses, brick foundations, in northern section of town, to J. A. Jones Constr. Co. Realty Bldg., Charlotte, N. C. About $250,000; cost plus percentage basis.

★Va., Schoolfield—Housing—Dan River & Riverside Cotton Mills, Danville, Va., let contract building 50 frame and stucco houses, brick foundations, here, to J. P. Pettyjohn & Co., 212 8th St., Lynchburg, Va. About $250,000 cost plus percentage basis.

★Ky., Bowling Green—Dormitory—Western Kentucky State Normal School let contract building 3 story, rein.-con. and brick, to Brashear & Cahill, Louisville. About $250,000.

★O., Cincinnati — Office — Western & Southern Insurance Co., 4th St. and Bway., let contract building 4 story, 54 x 78 ft., rein.-con. and brick, rein.-con. flooring, to M. Marcus Bldg. Co., 621 Main St. About $200,000.

O., Cleveland—School—Bd. Educ., East 6th St. and Rockwell Ave., received bids building 1 story, 212 x 212 ft., rein.-con., brick and steel, rein.-con. flooring, concrete foundation, on East 92nd St. and Parkgate Ave., from Drummond-Miller Co., 4500 Euclid Ave., $637,300, Tenbusch-Parker Constr. Co. 1836 Euclid Ave., $647,156, P. Kirschner, Hippodrome Bldg., $708,257. Noted May 27.

★O., Cleveland—School—Bd. Educ. East 6th St. and Rockwell Ave., let contract building 1 story, 132 x 144 ft., rein.-con., steel and brick addition, rein.-con. flooring, concrete foundation, on East 55th St. and Scoville Ave., to Tenbusch-Parker Co., 1836 Euclid Ave., $145,243. Noted April 29.

★O., Lakewood (Cleveland P. O.)—Church—First Church of Christ Scientist, c/o W. F. Kees, 931 Society for Savings Bldg., Cleveland, let contract building 1 story, 100 x 100 ft., rein.-con., steel and brick, rein.-con. flooring, concrete foundation, at 15422 Detroit Ave., to C. R. Cummins Co., Leader-News Bldg., Cleveland. About $100,000. Noted April 15.

★Mich., Flint—Theatre—J. Kovinsky let let contract building 2 story, 50 x 140 ft., rein.-con., brick and steel, rein.-con. flooring, concrete foundation, on North Saginaw St., to W. H. Isgrigg & Son, Flint. About $100,000. Noted May 20.

★Mich., Highland Park (Detroit P. O.)—Hotel—P. Christie, c/o S. E. Remey, archt., Whitney Office Bldg., Detroit, let contract building 4 story, 40 x 130 ft., brick, steel and stone, concrete foundation, on LaBelle Ave., to C. J. Ward & Son, Detroit. About $100,000. Noted April 1.

Ill., Ashland—School—School Dist. 212 let general contract building 1 story, 105 x 180 ft., concrete and brick, concrete foundation, to C. H. Schenk, 2068 South 5th St., Springfield. About $110,000.

★Ill., Chicago—Office—J. T. Ryerson & Son, 16th and Rockwell Sts. let general contract building 4 story (ultimately 8 story) 66 x 128 ft., brick and steel, rein.-con. flooring, concrete foundation, to G. Thomson & Co., 30 North LaSalle St. About $350,000.

★Wis., Manitowac — Theatre — George Bros. Co., 913 South 8th St., let contract building 1 story, 115 x 130 ft., rein.-con., brick and steel, brick foundation, on 58th St., to Badger State Constr. Co., c/o A. V. Lill, 1415 Washington St. About $300,000.

★Wis., Stratford—Store—R. Connor Co. let contract building 1 story, 100 x 120 ft., to G. Krasen, Marshfield. About $100,000.

★Ia., Mason City—Home—State I. O. O. F. Lodge let contract building 2 story, 58 x 140 ft., rein.-con., brick and steel, rein.-con. flooring, concrete foundation, to M. M. Moen & Co., Masonic City, $105,225.

★Kan., Peabody—Hotel—Forrester Hotel Co. let contract building 3 story, 50 x 111 ft., rein.-con., brick and steel, rein.-con. flooring, concrete foundation, to Scott Bros., Peabody. About $100,000; cost plus percentage basis.

★Neb., Loup City—Courthouse—Sherman Co. let contract building 3 story, 60 x 74, rein.-con., brick and steel, rein.-con. flooring, concrete foundation, to J. Ohlson & Son, Loup City. About $102,000.

★Mo., Carthage—Hotel—Drake Hotel Co. let contract building 4 story, 75 x 90 ft., brick, stone and rein.-con., rein.-con. flooring, to Manhattan Constr. Co., 3rd and Fondulac Sts., Muskogee, Okla. About $189,000. Noted June 10.

★Mo., Kansas City — Office — F. H. Thwing, Finance Bldg., let contract building 2 story, 49 x 115 ft. brick, rein.-con. flooring, on 13th and Walnut Sts., to Pratt & Thompson, Republic Bldg., About $100,000.

★Okla., Okmulgee—School—Bd. Educ. let contract for West Side school 1 story, 120 x 160 ft., rein.-con., brick and steel, rein.-con. flooring, concrete foundation, to Patti-Moore Co., Okmulgee. About $105,000; cost plus percentage basis.

★N. M., Mescalaro—Church—St. Joseph Church will build 1 story, 50 x 120 ft. stone church. About $100,000. Work will be done by day labor.

★Ore., Portland—Hospital—Comrs. Multnomah Co. let masonry contract for 5 story, 150 x 210 ft. hospital and boiler house, on Marquam Hill, to J. M. Dougan Co., Ry. Exch. Bldg., $347,435. Noted June 3.

★Cal., Los Angeles—Studio—Robertson-Cole Studios, Inc., Currier Bldg., let contract building motion picture studio, on Gower St. and Melrose Ave., to Milwaukee Bldg. Co., 403 South Hill St. Cost to exceed $100,000.

★Cal., San Francisco—Bank and Office—First Federal Trust Co., Montgomery St., let contract building 3 story, to Grace & Beonieri, 703 Market St. About $350,000. Former contract rescinded. Noted Jan. 22.

★Cal., San Francisco—Store and Loft—C. C. Moore & Co., Sheldon Bldg., let con-ny St. About $275,000. Noted April 15. tract building 5 story, rein.-con., on 1st and Mission Sts., to G. Wagner, 251 Kear-

★Que., Montreal—School—Protestant Bd. School Comrs. let general contract building Devonshire School, 3 story, 30 rooms, on Clarke, Cuthbert and Arcade Sts., to A. F. Byers Co., 340 University Ave., $326,865; heating, plumbing and ventilating, to W McGuire & Co., 332 Craig St., W., $63,5

★Que., Montreal—Theatre—Famous Pl ers Corp., Transportation Bldg., let contra constructing 90 x 165 ft., rein.-con. bri and steel, rein.-con. flooring, concrete fou dation, on Mansfield and Cathcart Sts., Atlas Constr. Co., 37 Belmont St. Abo $350,000.

★Ont., Hamilton—School—Bd. Educ. contract building 2 story, 12 room, co crete, brick and steel, rein.-con. flooring concrete foundation, to W. H. Coop Clyde Bldg., About $140,000.

Federal Government Work

PROPOSED WORK

N. Y., Stapleton—Laundry and Mecha cal Equipment—Treas. Dept., Wash., D. rejected bids received June 1, furnishi labor, material and mechanical equipm for laundry, here. J. A. Wetmore, super archt. Noted June 10.

D. C., Wash.—Boiler and Accessories Spec. 4242—Bureau Yards & Docks, Nav Dept., plans to build in heating plant Naval Observatory. About $10,000.

D. C., Wash.—Electric Traveling Cran Spec. 4239—Bureau Yards & Docks, Nav Dept., plans to build five 40 ton, for shi building slips at Navy Yards, at New Yor Phila. and Norfolk, Va. About $225,00

D. C., Wash.—Paving Ducts, etc.—S 4236—Bureau Yards & Docks, Navy Dept plans to build paving ducts, manhole sew and waterlines. About $102,000.

Va., Hampton Roads — Electric Underground Distributing System—Spec. 4240 Bureau Yards & Docks, Navy Dept., Wash D. C., plans to build in Block "Z," her About $38,000.

Va., Hampton Roads—Protection Covering—Spec. 4241—Bureau Yards & Docks Navy Dept., Wash., D. C., plans to buil for water piping, at Merchandise Pier 2 here. About $12,000.

S. C., Charleston — Repairing Avenue Spec. 4237—Bureau Yards & Docks, Nav Dept., Wash., D. C., plans to repair Av D between 3rd and 5th Sts., here. Abou $8,500. Bids will be opened at local yar

O., Cleveland—Repairing Breakwater an Placing Riprap—U. S. Engr. Office, Federal Bldg., rejected bids received May 20, repairing breakwater and placing riprap, at Cleveland Harbor. Noted April 15.

Mich., Alpena—Quarters — Spec. 4195 — Bureau Yards & Docks, Navy Dept., Wash D. C., received no bids June 16, building here. About $20,000. Noted June 10.

Mich., Detroit — Quarters—Spec. 4195—Bureau Yards & Docks, Navy Dept., Wash D. C., received no bids June 16 building, at Wind Mill Point, here. About $20,000 Noted June 10.

Mich., Detroit—Stone—U. S. Engr. Offic 337 Federal Bldg., rejected only bid receive May 20, furnishing stone for entrance t breakwater, at Beach Harbor. Noted Jun 10.

Wis., Milwaukee—Quarters—Spec. 4195—Bureau Yards & Docks, Navy Dept., Wash D. C., received no bids June 16, building at navy grounds, here. About $20,000. Noted June 10.

BIDS DESIRED

N. Y., New York—Dredging—Until July 24, by U. S. Engr. Office 39 Whitehall St dredging in Mattituck Harbor; advertised in this issue.

Pa., Pittsburgh—Gate and Valve Operating Machinery—Until July 15, by U. S Engr. Office, 2111 Farmers Bank Bldg., furnishing and delivering for Emsworth Dam Ohio River; advertised in this issue.

D. C., Tacoma Park—Materials and Supplies—Until June 26 of office of Utilities Officer, Ward 1, furnishing and delivering at U. S. Army General Hospital; advertised in this issue.

Va., Hampton Roads—Sewers, Drains and Water Mains—Spec. 4178—Until July 7, by Bureau Yards & Docks, Navy Dept., Wash D. C., laying sewers, drains and water mains around storehouse, here. About $40,000; $10 deposit required for plans and spec. Noted April 29.

Va., Quantico—Incinerator—Spec. 4137—Until July 7, by Bureau Yards & Docks, Navy Dept., Wash., D. C., building at Marine Barracks, here. About $67,000; $10 deposit required for plans and spec.

O., Athens—Brick Set, etc.—Until July 9, by Treas. Dept., Wash., D. C., building brick set, down draft, fire box, heating boiler, automatic gas water heater, storage tank, etc., here.

O., Zanesville—Additions and Repairs to Conduit, etc. — Until July 12, by Treas. Dept., Wash., D. C., repairing and building additions to conduit and wiring, new lighting fixtures and furniture lighting in U. S Post Office, here.

Federal Government Work (Continued)

Cal., San Diego — Refrigerating Plant Equipment—Spec. 4193—Until June 30, by Bureau Yards & Docks, Navy Dept., Wash., D. C., furnishing and installing in industrial building, here. About $50,000. Noted June 3.

Cal., San Diego—Storehouse—Spec. 4157—Until July 7, by Bureau Yards & Docks, Navy Dept., Wash., D. C., building, here. About $145,000. Noted June 3.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

★N. Y., Buffalo—Repairing Piers and Building Superstructure—U. S. Engr. Office, 540 Federal Bldg., let contract repairing and building at Dunkirk Harbor, to Empire Eng. Co., North Tonawanda, $55,786. Noted June 10.

★N. Y., New York — Dredging — U. S. Engr. Office, 39 Whitehall St., let contract dredging in Shrewsbury River, Shoal Harbor and Compton Creek, N. J., to J. R. Anderson, Albany, $27,750. Noted April 29.

★Pa., Phila.—Structural Steel Finishing—Spec. 4198—Bureau Yards & Docks, Navy Dept., Wash., D. C., let contract, at machine shop, here, to McClintic Marshall Co., 1421 Chestnut St., $34,972 (45 days).

★Pa., Pittsburgh—Gates and Emergency Dams—U. S. Engr. Office, 2111 Farmers Bank Bldg., let contract furnishing, delivering and building for Emsworth Locks, Ohio River, to Dravo Constr. Co., Diamond Bank Bldg., $168,776. Noted June 10.

Pa., Pittsburgh—Steel Lock Gates—U. S. Engr. Office, 2111 Farmers Bank Bldg., received lowest 3 bids June 14, furnishing and delivering for Lock 6, Monongahela River, involving: (a) 7,450 lb. forged, (b) 14,000 lb. cast, (c) 2,200 lb. c.i. (d) 242,900 lb. structural and (e) 310 lb. tool steel, etc., from Independent Bridge Co., May Bldg., (a) $0.30 per lb., (b) $0.30, (c) $0.20, (d) $0.11, (e) $1, total, $34,454; J. and J. B. Milholland Co., 714 5th Ave., (a) $0.20, (b) $0.25, (c) $0.15, (d) $0.1175, (e) $0.90, total $34,692; Penn Bridge Co., Beaver Falls, (a) $0.49, (b) $0.31, (c) $0.1125, (d) $0.1294, (e) $1.25, total $40,987. Noted June 3.

★D. C., Anacostia — Storehouse, Pigeon Loft and Hangar — Spec. 4085 — Bureau Yards & Docks, Navy Dept., Wash., let contract building at Naval Air Sta., here, to Hyde & Baxter, 711 13th St. N. W., Wash., $31,826 (60 days). Noted June 10.

D. C., Wash.—Raising Roof, etc.—Spec. 4075—Bureau Yards & Docks, Navy Dept., received bids June 16, raising roof of open hearth shop, at Navy Yard, here, (1) work complete, from Hyde & Baxter, 711 13th St., N.W., (1) $39,444 (200 days), (2) deduct $625, (3) add $60, deduct $30, (4) add. $0.80, deduct $0.20; Mansfield & Savage, 135 William St., New York City, (1) $53,330 (300 days), (2) $1,800, (3) $100, (4) add $3, (5) deduct $100. Noted June 3.

★Va., Hampton Roads — Seaplane Runway—Spec. 4181—Bureau Yards & Docks, Navy Dept., Wash., D. C., let contract building at Naval Operating Base, Air Sta., here, to Raymond Concrete Paving Co., 921 Munsey Bldg., Baltimore, Md., $55,864 (120 days). Noted June 10.

★Va., Hampton Roads—Sewerage System—Spec. 4133—Bureau Yards & Docks, Navy Dept., Wash., D. C., let contract building, here, to H. E. Crook Co., 28 Light St., Baltimore, Md., $15,220 (75 days). Noted June 10.

★Va., Hampton Roads — Underground Steam Lines—Spec. 4218—Bureau Yards & Docks, Navy Dept., Wash., D. C., let contract furnishing and installing, here, to J. R. Proctor, 74 Courtland St., New York City, $19,380 (125 days). Noted June 10.

★Va., Norfolk—Drainage System—Spec. 4131—Bureau Yards & Docks, Navy Dept., Wash., D. C., let contract building, here, to O. Dashiell, 507 South St., Portsmouth, $37,945 (30 days).

★W. Va., South Charleston — Electrical Equipment — Spec. 4146 — Bureau Yards & Docks, Navy Dept., Wash., D. C., let contract furnishing and installing, at main substation, Naval Ordnance Plant, here, to Westinghouse Electric Co., Hibbs Bldg., Wash., D. C., $219,530. Noted May 27.

★S. C., Charleston — Steel Tower — Spec. 4149—Bureau Yards & Docks, Navy Dept., Wash., D. C., let contract building, here, to W. F. Martens, 53 Franklin St., Rochester, N. Y., $25,568 (150 days). Noted June 10.

S. C., Paris Island—Overhang and Gratings—Spec. 4208—Bureau Yards & Docks, Navy Dept., Wash., D. C., received bids for overhang on Bldg. 11 and grating for 12 buildings at Marine Barracks, here, from Regan Constr. Co., 2 East Lexington St., Baltimore, Md., $13,288 (90 days); Central Constr. Co., 520 Beatty Bldg., Austin, Tex., $19,200 (90 days).

★Ga., Savannah — Radio Building and Towers — Spec. 4204 — Bureau Yards & Docks, Navy Dept., Wash., D. C., let contract constructing 4 radio buildings and towers, here, to Donnell-Zane Co., Inc., 350 Bway., New York City, $7,865 (20 days). Noted May 27.

★Fla., St. Petersburg—Operating Building—Spec. 4183—Bureau Yards & Docks, Navy Dept., Wash., D. C., let contract constructing, here, to W. F. Martens, 53 Franklin St., Rochester, $16,775. Noted June 10.

★Ala., Florence—Hydraulic Turbines—U. S. Engr. Office let contract furnishing and delivering 4 hydraulic turbines, each 30,000 hp. with governors, to W. Cramp & Sons, Ship and Engine Bldg., Phila., Pa., $519,600. Noted April 22.

O., Cincinnati—Lockkeepers Houses—Bureau Yards & Docks, Navy Dept., Wash., D. C., will build, on Dams 28 and 29, here. Work will be done by day labor.

★O., Cincinnati—Wall Power Plant—U. S. Engr. Office, 415 Custom House, let contract building wall power plant for Dams 33 and 39, Ohio River, as follows: Lot "A," turbines, to Trump Mfg. Co., Columbus Ave., Springfield, $4,510; Lot "A," other things not given for Dams 33 and 39, and Lot "B," valve jacks, to J. and J. B. Milholland Co., 714 5th Ave., Pittsburgh, Pa., $11,699 and $17,156 respectively; Lot "C," pipe fittings, etc, to Crane Co., 824 Bway., $13,985.

★O., Cleveland—Jetty and Pierhead—U. S. Engr. Office, Federal Bldg., let contract, building at Sandusky Harbor, to Central Dredging Co., Bangor Bldg., $169,711. Noted April 22.

★Mich., Detroit—Emergency Dam—U. S. Engr. Office, Federal Bldg., let contract furnishing and building emergency dam and bridge to have rein.-con. abutments over 3rd and 4th Locks, St. Mary's Falls Canal, to Independent Bridge Co., May Bldg., Pittsburgh, Pa., $137,890. Noted June 17.

N. D., Ft. Yates—Improving Water System—Comrs. Indian Affairs, Wash., D. C., received only bid June 14, improving at Standing Rock Agency, here, from Manden Plumbing & Heating Co., Manden, $14,438. Noted May 13.

★Tex., Ft. Worth — Cylinder Storage Building — Spec. 4142 — Bureau Yards & Docks, Nevy Dept., Wash., D. C., let contract constructing at U. S. Helium Production Plant, here, to Regan Constr. Co., 2 East Lexington St., Baltimore, Md., $83,281 (120 days). Noted June 17.

★Tex., Ft. Worth—Well Houses, Towers, Settling Basin and Piping—Spec. 4210—Bureau Yards & Docks, Navy Dept., Wash., D. C., let contract building, at Helium Production Plant, here, to Regan Constr. Co., 2 Lexington St., Baltimore, Md., $13,288 (90 days). Noted June 10.

★Cal., Mare Island—Electrify Causeway and Transfer Yard—Spec. 4188 — Bureau Yards & Docks, Navy Dept., Wash., D. C., let contract electrifying at Navy Yard, here, to San Francisco, Napa & Calistoga R.R. Co., Napa, $11,128 (30 days). Noted May 13.

P. R., Loiza—Buildings and Utilities—Spec. 4194—Bureau Yards & Docks, Navy Dept., Wash., D. C., received bids June 16, constructing at Naval Radio Control and Receiving Sta., here, (1) work complete, from Hyde & Baxter, 711 13th St., N.W., Wash., D. C., (1) $219,255 (240 days), (2) deduct $12,000 (10 days), (3) deduct $16,000, (4) deduct $23,000, (5) $500, (6) deduct $1,000, (7) deduct $11,800, (8) deduct $15,700; Stuart Eng. Co., 186 5th Ave., New York City, (1) $237,450 (175 days), (2) $16,725, (3) $19,850, (4) $20,775, (5) $810, (6) $700, (7) $16,500, (8) $19,625. Noted June 3.

★P. R., San Juan—Pipe—U. S. Engr. Office, 39 Whitehall St., New York City, let contract furnishing pipe for dredging in harbor, here, to Thompson Iron Wks., 1825 Callowhill St, Phila., $24,733.

★P. I., Guam — Electrical Equipment — Spec. 4169—Bureau Yards & Docks, Navy Dept., Wash., D. C., let contract for electrical equipment, to General Electric Co., River Rd., Schenectady, N. Y., $34,125 (180 days). Noted June 3.

★Alaska—Bridge—C. E. Dole, purch. agt., Alaska Eng. Comn., Seattle, Wash., let contract building 919 ft. steel arch bridge, 300 ft. above bottom of canyon, at Hurricane Gulch on Alaska Ry. Line, to U. S. Steel Products Co., 4th St. S. and Connecticut St., Seattle, Wash., $329,323. Noted Jan 22.

Miscellaneous

PROPOSED WORK

Paving Plant, etc.—New York, N. Y.—H. H. Curran, pres. Manhattan Boro., rejected bids received May 18, building plant for crushing, melting and mixing old asphaltic material, and altering present elevator at asphalt plant, on 90th St. and East River. About $60,000. Work will be readvertised. Noted May 13.

Pier and Shed—Bayonne, N. J.—Gulf Refining Co., foot Ingraham Ave., plans to build pier and steel shed at foot of East 5th St., also stock house. About $73,000 and $28,000 respectively.

Park Improvements — Manayunk, Pa. (Phila. P. O.) — Common Council voted $60,000 bonds to improve undeveloped tract at Cresson, Silverwood, Rector and Cotton Sts.

Minn., Duluth—Great Northern Power Co., Superior St. and 5th Ave. W., plans to build dam across Boulder Lake, to develop 50,000 hp., in order to supply additional electrical power to Duluth and towns on Minnesota iron ranges. About $500,000. W. N. Ryerson, mgr.

Dam — Buckeye, Ariz. — Buckeye Irrigation Dist. had plans prepared by C. K. Fox, engr., I. W. Hellman Bldg., Los Angeles, for 3,000 ft. diversion dam, 150 ft. wide, in Gila River, 8 ft. above river bed, concrete breast and toe walls and filled between with boulders, also 75 ft. apron of boulders and wire mesh. About $450,000.

Wharf — Three Rivers, Que. — City soon receives bids building 350 ft. wharf along river front, 500 ft. deep. Z. Lambert, city engr.

BIDS DESIRED

Terminal Freighthouse—New York, N. Y.—Until July 20, by E. S. Walsh, supt. pub. wks., Capitol, Albany, building at Mott Haven, Bronx Boro., here; advertised in this issue.

Wood Block—Cincinnati, O.—Until June 29, by E. Von Bargen, purch. agt., City Hall, furnishing 50,000 wood blocks.

Coal Crusher—Cleveland, O.—Until July 2, by E. Shattuck, comr. of purch. furnishing 1 motor driven power house type coal crusher.

Pumps—Cleveland, O.—Until July 2, by city, furnishing and installing two 8,000,000 gal. and one 4,000,000 gal. motor driven vertical centrifugal pumps with motors, electrical equipment, piping, valves, etc. involving 5 tons 24 in. c.i. pipe. Cost to exceed $25,000. Noted June 17.

Minn., Waseca—Ditch—Until June 28, by Waseca Co., cleaning 1,100 ft. Ditch 18. Work involves 50 ft. 22 in. sewer pipe, 17,988 ft. 6-22 in. tile, 1 bulkhead and 11 surface water inlets. G. Cox, Waseca, engr.

Road Rollers, etc.—Marion, Ark.—Rd. Impvt. Dist. 7, 8 and 9, Crittenden Co. (Marion) and Ozark Trail Rd. Impvt. Dist., Poinsett Co., (Harrisburg) receiving bids for two or three 10 ton road rollers, graders, etc. Morgan Eng. Co., Goodwyn Institute Bldg., Memphis, Tenn., engrs.

Breakwater—Friars Head, N. S.—Until June 28, by R. C. Desrochers, secy. Dept. Pub. Wks., Ottawa, improving breakwater.

Wharf—Ste. Famille, Que.—Until July 6, by R. C. Desrochers, secy. Dept. Pub. Wks., Ottowa, rebuilding and repairing wharf, here.

Pier—Bayfield, Ont.—Until July 6, by R. C. Desrochers, secy. Dept. Pub. Wks., Ottawa, rebuilding portion of South Pier.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

★Field and Shelter Houses—Boston, Mass.—City let contract building on Eagle Hill Reservoir, to A. Piotti Co., $36,784.

Subway Subtrack—New York, N. Y.—J. H. Delaney, comr, transit constr., 49 Lafayette St., received bids June 9, completing Sect. 2, Route 8, of 14th St.—Eastern Rapid Transit R.R. extending under East 14th St. from Irving Pl. to Ave. B, from P. McGovern, 50 East 42nd St., $3,336,000, Booth & Flynn, 17 Battery Pl., $3,488,000, Underpining & Foundation Co., 290 Bway., $3,680,000. Noted May 20.

★Truck—Sheboygan, Wis.—City let contract furnishing and equipping 1 Winther Model 149, 7 ton truck, with 1,500 gal. capacity, Studebaker flushing unit, to Automotive Sales & Service Co., Inc., Fond du Lac, $11,975.

★Levee—Newport, Ark.—Newport Levee Dist. let contract building earth levee and concrete levee wall, to W. H. Denison, Cushman. About $125,000. Work involves 17,900 cu.yd. earth embankment, 2,700 cu.yd. stripping, 3,100 cu.yd. excav. and backfill, 2,320 cu.yd. rein.-con., 140,000 lb. reinforcing steel, 78 m. ft. tongue and groove wood sheet piling, 37 m. ft. interlocking wood sheet piling, etc.

★Portland Cement — Portland, Ore. — State Highway Comn. let contract furnishing 10,000 bbl., to Beaver Portland Cement Co., Spalding Bldg., $4.26 per bbl.

★Roofing—Toronto, Ont.—City let contract building copper roof for City Hall, to W. E. Dillon, 183 George St. About $126,000. Noted April 29.

OFFICIAL PROPOSALS

July 1.

Sanitary Sewers and Septic Tanks

WORK FOR MACHINE EXCAVATOR

Waterloo, Wis.

Sealed proposals for the construction of sanitary sewers and appurtenances in Waterloo, Wisconsin, will be received until 5.00 p.m. on Thursday, July 1st, 1920.

The work comprises approximately:

16,106 lin.ft. of 8-in. Sewer;
4,170 lin.ft. of 10-in. Sewer;
4,220 lin.ft. of 12-in. Sewer;
2 River Crossings of Inverted Siphons;
72 Manholes;
Septic Tanks.

Bids will be received on both Vitrified and Concrete Sewer Pipe, subject to the choice of the Village Board.

The Village of Waterloo does not guarantee the character of the subsoil, but for the information of bidders the statement is made that nearly all the excavating is considered good machine work.

A certified check for at least five per cent (5%) of the aggregate of the bid must accompany each proposal, made payable to the village treasurer. Bidders who submit proposals on both Vitrified and Concrete pipe will use a separate blank for each but will only be required to submit a check based on the highest one.

Specifications and form of contract will be ready June 10th, 1920, and can be had by addressing the Engineers. Plans and profiles can be inspected at the office of the Village Clerk or at the office of the Engineers. Bidders desiring a set of the plans mailed to them can procure same by addressing the Engineers, enclosing $3.00 to cover the cost of blue prints

PARSONS & ORBERT, Engineers,
627 M. & M. Bank Bldg.
Milwaukee, Wis.

W. J. HIGGINS, Village Clerk,
Waterloo, Wis.

Bids: July 15.

Reconstruction of Road

Flemington, N. J.

The Board of Chosen Freeholders of Hunterdon County will receive bids at their rooms in Flemington, N. J., on July 15, 1920, up to the hour of 11 o'clock a.m. (daylight saving time), for the reconstruction of the following sections of County Roads with bituminous macadam, penetration surface.

First Section—Lambertville, Ringoes Road From Lambertville City Line to Pancoasts Lane. Length, 1,238 miles.

Second Section—Lambertville, Ringoes Road From Jess Runkles driveway northward to Station 210-50. Length, 0.833 miles.

Third Section—Flemington, Ringoes Road From near Copper Hill Bridge southward to Rockafellows Lane. Length, 0.909 miles.

Fourth Section—Whitehouse, Flemington Rd Beginning at Birds Corner, extending southward to Flemington Borough Line. Length, 0.602 miles.

Fifth Section—Whitehouse, Flemington Rd. Beginning at over Railroad Bridge and extending to Lehigh Valley Railroad branch track. Length, 0.616 miles.

Bids will be received on the above in two groups:

GROUP "A," composing first and second sections.

GROUP "B," composing third, fourth and fifth sections.

Bids will also be received at the same time and place for a concrete pavement for Sections 4 and 5.

Specifications for the above are on file and may be examined at the office of Grant Davis, County Engineer, Whitehouse Station, N. J., also at the office of H. L. Stout, County Solicitor, Flemington, N. J.

A certified check for five hundred ($500) dollars must accompany each bid. Bid must be inclosed in a sealed enevelope addressed to the Director of the Board of Chosen Freeholders, and stating the subject of the bid.

By Order of the Board.

W. W. FOSTER, Clerk.

June 17, 1920.

The publication of an advertisement on this page is an official notice that bids are wanted from other than local bidders.

It is also a guarantee that maximum competition is invited because Engineering News-Record is the *one* nationally recognized medium for Proposal advertising. Its Searchlight Section is read each week by nearly every worth-while contractor in this country who bids on public work outside his own city.

Official Proposals reaching our office in first mail Wednesday morning (9 o'clock) can usually be published in the issue out the next day. Special price for Official Proposals, 40 cents a line.

Bids: July 20.

Construction of Barge Terminals

STATE OF NEW YORK
OFFICE OF SUPERINTENDENT OF PUBLIC WORKS

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until 12 o'clock noon of Tuesday, July 20, 1920, at which place and hour they will be publicly opened and read, for the construction of a Barge Canal terminals pursuant to the provisions of Chapter 746 of the Laws of 1911, and of the acts amendatory thereof, as follows:

TERMINAL CONTRACT No. 224

For constructing a terminal freighthouse at Mott Haven, Borough of Bronx, New York City.

Contract plans, sheets 1 to 13, inclusive.

Plans may be seen and detailed specifications, engineer's estimates of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., at the canal office, Spaulding's Exchange, Buffalo, N. Y., and at the office of the Superintendent of Public Works, Terminal Warehouse, Pier 6, East River, New York City.

Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the city of Albany or New York, issued by a national or state bank or trust company in good credit within the state and payable at sight to the Superintendent of Public Works for five per centum (5 per cent) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

The bond required for the faithful performance of each contract shall be in such sum as shall be fixed by the Superintendent of Public Works, which sum shall not be less than twenty per centum (20 per cent) of the estimated cost of the work, according to the contract price, and an additional bond known as the labor bond, in the sum of ten per cent (10 per cent) of the amount of the estimated cost of the work according to the contract price, will be required as security that the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one surety company is offered as surety on said bonds co-insurance only will be accepted.

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the state for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned, the interests of the state will be enhanced thereby.

EDWARD S. WALSH,
Superintendent of Public Works.

Albany, June 16, 1920.

Bids: July 1.

State Road and Bridge Construction

Fort Worth, Tex.

Sealed proposals addressed to W. E. Yancy, County Auditor, for the improvement of certain highways in Tarrant County, will be received at the office of County Auditor, at Fort Worth, Texas, until **10 o'clock a.m., July 1, 1920**, and then publicly opened and read.

Description of Work to Be Done

The construction of 5.857 miles of reinforced concrete pavement and all bridges, culverts, etc., on State Highway No. 1, known as the Bankhead Highway, running from the Dallas County line west through Arlington, all in Tarrant County and being a section of the Fort Worth-Dallas Pike.

Detailed plans and specifications of the work may be seen for examination, and information may be obtained at the office of the Consulting Engineer, care Court House, at Fort Worth, Texas, and at the office of the State Highway Department, State Office Building, Austin, Texas.

A certified or cashier's check for five thousand dollars ($5,000.00), made payable without recourse to the order of Hugh L. Small, County Judge of Tarrant County, must accompany each proposal as a guarantee that the bidder, if successful, will enter into contract and make bond in accordance with requirements of the specifications. The right is reserved by the party of the first part to reject any and all proposals or to waive all technicalities. Proposals shall be submitted in sealed envelopes and marked "Bids for the Construction of the Fort Worth-Dallas Pike Road in Tarrant County." All bids received will be retained by the Department and will not be returned to the bidders.

Y. E. YANCY,
County Auditor.

Bids: July 6.

Construction of Storm Sewers

Boonton, N. J.

Sealed bids or proposals for laying, furnishing and excavating for storm sewers, together with the erection and construction of eight catch basins, will be received and opened at the Board of Aldermen Rooms, Boonton, N. J., on Tuesday, July 6, 1920, at 8:30 o'clock P.M.

The schedule of work is as follows: Parties desiring further information will apply to the Town Clerk, Boonton, N. J., by depositing a check for $5.00 will receive plans and specifications.

ARTHUR TAYLOR.
Ch. Street Com.

OFFICIAL PROPOSALS

Bids: July 7.

Construction of Bridge

Red Bank, N. J.

Notice is hereby given that sealed bids will be received by the Board of Chosen Freeholders of the County of Monmouth for the construction of Hubbards Bridge, No. S-17, over the North Shrewsbury River, Red Bank, New Jersey, and opened and read in public at the rooms of the said board, Court House, Freehold, N. J., on Wednesday, July 7th, 1920, at 11:00 a.m.

Drawings and specifications for the proposed work, prepared by George D. Cooper, County Engineer, have been filed in the office of said Engineer, at 60 Broad Street, Red Bank, N. J., and will be furnished to prospective bidders upon payment of ten dollars ($10), which amount will be refunded upon return of plans and specifications before the time specified for the opening of bids.

Bids must be made on the standard proposal forms in the manner designated therein and required by the specifications, must be enclosed in sealed envelopes, bearing the name and address of the bidder and name of proposed work on the outside, addressed to the Board of Chosen Freeholders of the County of Monmouth and must be accompanied by a certified check for a sum equal to ten (10) per cent of the amount bid on the work, payable to the order of the Collector of the County of Monmouth, and a surety company certificate stating that said surety company will provide the bidder with the required bond, and must be delivered at the place and on the hour above named.

The Board of Chosen Freeholders of the County of Monmouth reserves the right to reject any or all bids if deemed to the best interests of the County so to do.

By order of the Board of Chosen Freeholders of the County of Monmouth.

WILLIAM M. BERGEN,
Director.
Attest:
C. E. CLOSE, Clerk.
Freehold, N. J., June 9th, 1920.

Bids: July 5.

Construction of State Road

PROJECT NO. S 18.93 SEC. A

New Madrid, Mo.

Sealed proposals addressed to the County Clerk, New Madrid, Missouri, and endorsed "Proposal for construction (or improving) State Road, Project No. S 18.93, Sec. 'A,'" will be received by the Court until 2 o'clock p.m., on the 5th day of July, 1920, and at that time will be publicly opened and read at the County Court House.

The proposed work includes grading and constructing culverts together with any other incidental work on the State Road from New Madrid westwardly a distance of 19.3 miles.

Plans and specifications are on file and may be inspected in the office of the undersigned, or at the offices of the State Highway Department, Jefferson City, Mo.

A set of plans and specifications may be obtained from the undersigned upon deposit of ten dollars ($10.00), which amount will be refunded if both plans and specifications are returned in good condition within ten days after date of awarding the contract.

Proposals shall be submitted upon blank forms provided for the purpose by the undersigned, and shall be accompanied by a certified check, cash deposit, or proposal bond for six thousand dollars ($6,000.00).

The right is reserved by the Court to reject any or all bids.

County Court of New Madrid County,
Missouri New Madrid, Missouri.
C. V. HANSEN,
Highway Engineer.
New Madrid County.

Bids: July 14.

Street Paving

Tavares, Fla.

Town of Tavares, Lake County, Florida, will let about twenty-five thousand (25,000) square yards of Street Paving, and will offer for sale forty to sixty thousand dollars ($40,000 to $60,000) of Municipal Street Improvement Bonds to cover cost of same. Bond sale at 1:30 o'clock and street letting at 3 o'clock p.m. on the 14th day of July, 1920.

HON. R. L. NUTT,
Mayor.
EMORY J. CLOSE,
City Clerk and Resident Eng.
J. W. Turner, Lakeland, Florida.
Engineer in charge.

OFFICIAL PROPOSALS

Bids: July 12.

Construction of Bridge

Media, Pa.

Sealed proposals will be received at the offices of the Controller's of Delaware County and Chester County at Media, Pa., and West Chester, Pa., respectively, on Monday, July 12th, 1920, until 1:30 o'clock p.m., and opened at 2:30 o'clock p.m., at the office of the Commissioners of Chester County at West Chester, Pa., for a twin span reinforced concrete arch bridge of 75 ft. each with roadway of 22 ft. and one 4 ft. sidewalk over Brandywine Creek at Chadds-Ford in line of Baltimore Pike.

Bids from other than those engaged or established in business for which the proposals are asked will not be entertained, and no bid will be entertained unless made on printed blank forms furnished by the County Commissioners of said Counties.

All bids must be accompanied by a certified check of $1,000.00, drawn to the joint order of the Commisioners of said Counties.

A copy of the plans and specifications can be had by applying at the offices of the Commissioners of either of said Counties on the deposit of $10.00.

The County Commissioners of the said Counties have the right to reject any or all bids.

GEORGE S. DEWEES,
Controller of Chester County.
ORION L. DAVIS,
Controller of Delaware County.

Bids: July 2.

Bridge Construction

Lyons, N. Y.

Sealed proposals for the construction of a reinforced-concrete arch bridge, consisting of two 50-foot spans, with pier, abutments and appurtenant structures, will be received by Charles W. Barrick, Town Superintendent of Highways, at the office of the Town Clerk in the Village of Lyons, N. Y., until 1 p.m., July 2, 1920, at which time they will be opened and read.

A certified check, in the sum of five per cent of the amount of the bid, made payable to the Town Board of the Town of Lyons, must accompany each bid.

A surety bond to guarantee faithful performance, in the sum of fifty per cent of the amount of the bid, will be required from the successful bidder.

Plans and specifications may be seen at the office of V. A. Berns, Town Clerk, Lyons, N. Y., or at the office of E. J. Doyle, Consulting Engineer, 95 State Street, Albany, N. Y. Copies of plans and specifications may be had by depositing $10, which will be returned upon the return of the plans and specifications in good condition.

V. A. BERNS, Town Clerk.

Bids: June 28.

Paving

Newton, N. J.

Notice is hereby given that sealed bids will be received by Sussex County for the paving of Ross' Corner-Sussev Road, Section 1-C, in the Township of Frankford, in the County of Sussex, with Reinforced Concrete surface; estimated amount of surface pavement required is 24,504 square yards, and opened and read in public at The Freeholders' Room, Newton, New Jersey, on June 28, 1920 at 11 a.m.

Drawings, specifications and forms of bid, contract and bond for the proposed work, prepared by Harvey Snook, County Engineer, and approved by the State Highway Commission, have been filed in the office of the said engineer at Court House, Newton, New Jersey, and of said State Highway Commission, Trenton, New Jersey, and may be inspected by prospective bidders during business hours. Bidders will be furnished with a copy of the specifications and blue prints of the drawings by the engineer on proper notice and payment of cost of preparation. Bids must be made on the standard proposal forms in the manner designated therein and required by the specifications, must be enclosed in sealed envelopes, bearing the name and address of bidder and name of road on the outside, addressed to The County of Sussex, and must be accompanied by a certificate from surety company, and a certified check for not less than $1,000.00, and be delivered at the place and on the hour above named. The standard proposal form is attached to the specifications, copies of which will be furnished on application to engineer.

By order of The County of Sussex.

R. LEE SLATER, Clerk.

OFFICIAL PROPOSALS

Bids: June 30.

Construction of Bridges

STATE OF RHODE ISLAND
STATE BOARD OF PUBLIC ROADS

Providence, R. I.

Sealed proposals for the construction of State Bridges numbered 20, 145 and 146, commonly known as the Wakefield Bridge, South Kingstown, the Centerdale Sluiceway, North Providence, and the Centerdale Bridge, North Providence and Johnston, R. I., will be received at the office of the State Board of Public Roads, Room 12, State House, Providence, R. I., until 12 o'clock noon, on Wednesday, June 30, 1920, at which time the proposals will be publicly opened and read. Each proposal must be submitted upon a blank form furnished by the Board and accompanied by a certified check for two hundred dollars ($200), made payable to the State of Rhode Island.

The contracts will include the removal of the old structures and the erection of three concrete bridges containing approximately two hundred and ninety-two (292), two hundred and sixty-two (262) and six hundred and seventy-eight (678) cubic yards of concrete, respectively.

Plans and specifications for this construction will be available on and after 10 a.m., Monday, June 21, 1920, and may be obtained from the office of the State Board of Public Roads by making a deposit of $10, which will be refunded upon return of plans and specifications complete and in good condition.

STATE BOARD OF PUBLIC ROADS.
ABRAM L. ATWOOD,
BENJAMIN F. ROBINSON,
FRANK COLE,
J. HENRY WOODARD,
ALTON HEAD.

Bids: July 3.

Construction of Concrete Bridge

Granville, N. Y.

Sealed proposals will be received by the Town Board of the Town of Granville, N. Y., at the office of the Town Clerk in the village of Granville, N. Y., until 2 o'clock p.m., of the 3rd day of July, 1920, for furnishing labor, materials, etc., for the construction of a single span, reinforced, concrete arch over the Nettowee River on Church Street in said town, said construction to be in accordance with said plans and specifications on file with the Town Clerk.

Proposals must be on a form provided by the town and shall specify the amount bid for all work above the water surface and the price per cubic yard for all concrete below the indicated water surface in the manner prescribed in the plans and specifications, for which the work will be performed and materials furnished, together with a unit price for each of the separate items called for.

Each proposal must be accompanied by a certified check upon a bank or Trust Company in good credit within the state and payable at sight to the Town of Granville, N. Y., for five per centum of the amount of the proposal. The check deposited by the bidder to whom a contract is awarded will be forfeited if the said bidder shall fail or refuse within ten days after such award, to execute the final contract and deliver the bond hereinafter required. Upon execution of the contract and approval of the bond the deposit will be returned to the bidder and all other deposits will be returned to the persons having made them.

The successful bidder to whom a contract is awarded will be required to execute a good and sufficient bond of indemnity of a duly authorized guaranty company in the amount of one-half the amount of the contract as security for the faithful performance of all covenants and agreements on the part of the contractor contained in said contract and specifications.

Proposals should be addressed to the Town Clerk, Granville, N. Y., and inclosed in a sealed envelope marked, "Proposals for Constructing Church Street Bridge." Bids will be publicly opened and read at a meeting of the Town Board held at the time and place aforesaid and the award of the contract made as soon thereafter as practicable.

The right is reserved to reject any and all votes.

TOWN BOARD OF TOWN OF
GRANVILLE, N. Y.
JAMES N. MASON,
Town Clerk.
Dated: June 10, 1920.

OFFICIAL PROPOSALS

Bids: July 6.

Sewer Construction

Coatesville, Pa.

Sealed proposals will be received by the City Council of the City of Coatesville, Pa., at the City Hall, until 8 o'clock p.m., on the 6th day of July, 1920, for the furnishing all materials, labor and constructing complete, sanitary and storm sewers and appurtenances. The work to be done is approximately as follows:

SANITARY SEWERS

13,500 lineal feet 8-in. sewer
425 lineal feet 10-in. sewer
800 lineal feet 15-in. sewer
45 manholes
12 flush tanks
3 lampholes

STORM SEWERS

600 lineal feet 24-in. sewer
600 lineal feet 20-in. sewer
900 lineal feet 18-in. sewer
1,400 lineal feet 15-in. sewer
850 lineal feet 12-in. sewer
575 lineal feet 10-in. sewer
16 manholes
30 inlets

Proposals will be received for terra cotta pipe and fittings and cement-concrete pipe and fittings.

Plans and specifications are on file in the office of the City Engineer, City Hall, Coatesville, Pa., and copies of same may be obtained on application. A deposit of five ($5) dollars will be required for a set of plans.

All proposals must be made out on forms furnished by the City Engineer and must be accompanied by a certified check in an amount equal to five (5) per cent of the total amount bid. Check to be made payable to Treasurer of the City of Coatesville without reservations.

A satisfactory surety bond in an amount equal to the total amount bid will be required of the successful bidder.

The City Council reserves the right to reject any and all bids or to award the contract as may be deemed for the best interests of the City.

Contractors must comply with all the requirements of the Workmen's Compensation Act of the State of Pennsylvania.

FRANK P. PENNEGAR, City Clerk.
GEORGE ROMMEL, JR., City Engineer.

Bids: July 1.

Highway Construction

Montpelier, Vt.

Sealed proposals will be received at the office of the State Highway Commissioner at Montpelier, Vermont, on Thursday, July 1st at 2 o'clock p.m., for the construction of 4.03 miles of Bituminous Macadam road in South Burlington and Shelburne; 4.07 miles of waterbound Macadam road in New Haven, Waltham and Ferrisburg; 0.71 miles of waterbound Macadam in St. Albans; 0.73 miles of waterbound Macadam in Barnet; 13.57 miles of gravel road in Dorset, Mt. Tabor and Danby; 5.60 miles of gravel road in Dummerston, and 1.26 miles of gravel road in East Montpelier, Vermont.

Plans and specifications may be seen at the office of the State Engineer at Montpelier, Vermont.

Bidders should satisfy themselves, before bidding, as to the character of the work and the obstacles to be encountered. The estimated quantities are not guaranteed, but are given as a basis for the comparison of bids.

A certified check for 1 per cent of the bid, but not less than $500.00, payable to the State Highway Commissioner, must accompany each bid.

The right is reserved to reject any and all bids.

S. B. BATES,
State Highway Commissioner.
Dated: June 14, 1920.

Bids: July 6.

Construction of Sewers

Danville, Ky.

Sealed proposals will be received by the Mayor of Danville, Ky., in his office or in Council Chamber until 7:30 p.m., July 6, 1920, for the construction of 5,000 ft. of small sewers and 33,000 sq.yds. of street paving. One of the following types of paving to be selected after receiving bids: Sheet Asphalt, Bitulithic, Bitoslag, Willite on 5 or 6 inch base, or two course concrete. Plans and specifications may be seen at the office of S. F. CRECELIUS, Civil Engineer, Richmond, Ky. or at the office of the Mayor, Danville, Ky.

OFFICIAL PROPOSALS

Bids: July 6.

Paving

STATE OF MARYLAND
STATE ROADS COMMISSION

Baltimore, Md.

Sealed proposals for building one section of State Highway, as follows:

BALTIMORE CITY CONTRACT
No. Bc-34:

Paving Philadelphia Road from end of sheet asphalt to New City Line, for a distance of 2.1 miles of sheet asphalt to be laid on reconstructed stone base.

will be received by the State Roads Commission, at its offices, 601 Garrett Building, Baltimore, Maryland, until 12 M. on the 6th day of July, 1920, at which time and place they will be publicly opened and read.

Bids must be made upon the blank proposal form which, with specifications and plans will be furnished by the Commission upon application and cash payment of $1, as hereafter no charges will be permitted.

No bids will be received unless accompanied by a certified check for the sum of five hundred ($500) dollars, payable to the State Roads Commission.

The successful bidder will be required to give bond, and comply with the Acts of the General Assembly of Maryland, respecting contracts.

The Commission reserves the right to reject any and all bids.

By Order of the State Roads Commission this 18th day of June, 1920.

J. N. MACKALL, Chairman.
CLYDE H. WILSON, Secretary.

Bids: July 7.

Paving

STATE OF MARYLAND
STATE ROADS COMMISSION

Baltimore, Md.

Sealed proposals for building the following:

BALTIMORE CITY,
CONTRACT BC-35

Paving Belair Road from Old City Line to Hamilton Avenue, 1.94 miles of sheet asphalt to be laid on reconstructed stone base.

will be received by the State Roads Commission, at its offices, 601 Garrett Building, Baltimore, Maryland, until 12 M. on the 7th day of July, 1920, at which time and place they will be publicly opened and read.

Bids must be made upon the blank proposal form which, with specifications and plans will be furnished by the Commission upon application and cash payment of $1, as hereafter no charges will be permitted.

No bids will be received unless accompanied by a certified check for the sum of five hundred ($500) dollars, payable to the State Roads Commission.

The successful bidder will be required to give bond, and comply with the Acts of the General Assembly of Maryland, respecting contracts.

The Commission reserves the right to reject any and all bids.

By Order of the State Roads Commission this 18th day of June, 1920.

J. N. MACKALL, Chairman.
CLYDE H. WILSON, Secretary.

Bids: July 6.

Construction of Pavement

Wilmington, Del.

Proposals addressed to the New Castle County State Highway Commissioner, Room 133, County Building, Wilmington, Delaware, will be received until 12 o'clock noon (Wilmington time), Tuesday, July 6, 1920, for the construction of alternate types of standard pavement, on the Lincoln Highway, beginning and connecting to the contract known as Section No. 4, Lincoln Highway, near Pike's Creek and extending to Roseville bridge, a distance of 2.2 miles in Mill Creek hundred, and known as Section No. 5A of Lincoln Highway.

Plans and specifications may be seen at the Highway Commissioner's office, Room 133, County Building, on and after June 28, 1920, and a set secured upon making a deposit of $20, which will be refunded upon their return on or before July 10, 1920.

A certified check or bond for $500 must accompany each bid.

The Levy Court reserves the right to reject any or all bids.

CHARLES E. GRUBB,
New Castle County State Highway
Commissioner.

OFFICIAL PROPOSALS

Bids: July 7.

Construction of Pavements

Hudson Falls, N. Y.

Sealed proposals, addressed to L. Lewis, Village Clerk, Hudson Falls, N. Y and endorsed proposals for constructin John Street Pavement, Hudson Falls, N. Y will be received at the Village Hall by th Village Board until 8 p.m. o'clock of th 7th day of July, 1920, and at that time an place will be publicly opened and read.

Persons proposing to bid shall obtai from L. R. Lewis, Village Clerk, Hudso Falls, N. Y., pamphlet containing informa tion for proposers, itemized proposal, spec fications and contract.

The work consists of

1 catch basin
30 lin.ft. 8-in. sewer pipe laid
150 lin.ft. 6-in. sewer pipe laid
1,400 cu.yd. earth excavation
2,580 lin.ft. curb
3,800 sq.yd. concrete pavement

The village reserves the right to reject any or all bids.

L. R. LEWIS, Village Clerk.
Hudson Falls, N. Y. Hudson Falls, N. Y
June 16, 1920.

Bids: July 12.

Street Paving

Auburn, N. Y.

Sealed proposals will be received by John P. Jackel, city manager, Auburn, N. Y., up until noon, July 12, 1920, for the paving of Orchard Street from the west line of James Street to the east line of South Division Street, in the City of Auburn, N. Y., with approximately 12,000 square yards of either bitulithic concrete or brick pavement and the laying of about 6,500 feet of cement curbing. Plans and specifications are on file in the office of city engineer M. F. Dullea, Auburn, N. Y. A certified check payable to City of Auburn for 2½ per cent of the price bid must accompany each proposal. The right is reserved to reject any and all proposals.

For further particulars inquire of the city manager or city engineer, Auburn, N. Y.

JOHN P. JACKEL,
City Manager

Bids: June 30.

Reconstruction of Road

STATE OF RHODE ISLAND
STATE BOARD OF PUBLIC ROADS

Providence, R. I.

Sealed proposals for the reconstruction under the provisions of the Federal Aid Road Act of a section of State Highway in the towns of Coventry and West Greenwich beginning at the village of Washington and extending southerly and westerly upon the Nooseneck Hill, so-called, for a distance of 4.4 miles, will be received by the State Board of Public Roads at its office, State House, Providence, R. I., until 12 M. on Wednesday, June 30th, 1920, at which time they will be opened and read in public.

The principal estimated quantities are as follows:

Clearing and grubbing	12 acres
Earth excavation	27,700 cu.yds.
Ledge excavation	1,500 cu.yds.
Gravel foundations	3,000 cu.yds
Pipe culverts	690 lin.ft
Catch basins	11
Concrete masonry	285 cu.yds.
Cobble gutter	1,300 sq.yds.
Wooden guard railing	8,400 lin.ft.
Concrete pavement	9,700 cu.yds.

Bids must be made upon blank forms to be furnished by the Board.

No bids will be accepted unless accompanied by a certified check for the sum of $200.00 payable to the State of Rhode Island.

The Board reserves the right to reject any and all bids and to give preference to towns or cities in accordance with Section 5 of Chapter 84 of the General Laws.

Plans may be examined and specifications and bidding blanks may be obtained at the office of the State Board of Public Roads, State House, Providence, R. I., on and after Monday, June 21st 1920, every week day (except holidays and Saturdays) between the hours of 9 a.m. and 5 p.m., Saturdays 9 a.m. to 12 M.

STATE BOARD OF PUBLIC ROADS.
Abram L. Atwood,
Benjamin F. Robinson.
Frank Cole,
Alton Head,
J. Henry Woodard.

Bids: July 16.

Domestic Science and Arts Building

FULLERTON UNION HIGH SCHOOL AND JUNIOR COLLEGE

Fullerton, Cal.

The Board of Trustees of the Fullerton Union High School, Fullerton, California, will receive sealed proposals up until 2:00 o'clock p.m., Friday, July 16, 1920, at the office of the Principal in the Study Hall of the Fullerton Union High School and Junior College, at which time and place said bids will be opened and read in public, for furnishing the required labor and materials for and erecting and completing the new Domestic Science and Arts Building in accordance with plans and specifications prepared therefor by Carleton Monroe Winslow, Architect, 1134 Van Nuys Building, Los Angeles, California.

Bids will be received separately for the different parts of the work as follows:

Contract No. 1—General work, including concrete, masonry, carpentry, metal work, roofing, tile floors, plastering, painting, electric wiring, etc. (The above contract will not include excavation and grading except for footings, arcade and tunnel.)

Contract No. 2.—Heating and ventilation.

Contract No. 3.—Plumbing.

Cashier's or certified check or bidder's bond for an amount not less than five per cent (5%) of amount of bid shall accompany each proposal drawn, payable to the order of the Board of Trustees, as a guarantee that the bidder will within five (5) days after being informed of the acceptance of his bid, enter into a contract with the said Board of Trustees in accordance with the same and shall furnish the surety bonds as required by the specifications; said check or bond to be forfeited to the said Board should the bidder fail to execute and furnish bond as above mentioned.

All bids to be made on forms furnished by the architect.

Plans and specifications for all of the above work may be seen at the office of the architect, and also at the office of the Board of Trustees, where they may be secured for bidding.

A deposit of $10.00 will be required from all contractors receiving plans and specifications, which will be refunded when the plans and specifications are returned in good condition.

The said Board reserves the right to reject any or all bids and to waive any informality in any bid received.

By order of the Board of Trustees, Fullerton Union High School, Fullerton, California. By O. A. KREIGHBAUM.

June 3, 1920. Clerk of the Board.

Bids: July 23.

Constructing and Equipping Purification Plant Extension

BUREAU OF WATER WORKS IMPROVEMENT

CONTRACTS NOS. 170 AND 205

Akron, Ohio.

Sealed bids covering the construction and equipment of an addition to the Water Purification Plant will be received at the office of the Director of Public Service, Delaware Building, Akron, Ohio, until 12 o'clock noon (Central Standard Time) of Friday, the twenty-third day of July, 1920, and at that time and place will be publicly opened and read.

The work is divided into two separate contracts as follows:

Contract No. 170 for Constructing Purification Plant Extension comprises the construction of the concrete and brick structures for ten rapid sand filters having a capacity of two million gallons daily each, 750 linear feet of 30 in. vitrified pipe sewer, and a small sewage disposal tank.

The work involves the excavation of about 7,500 cubic yards of earth and the placing of about 2,500 cubic yards of reinforced concrete.

Contract No. 205 for Furnishing and Installing Filter Equipment and Piping includes the following items in the equipment of eleven (11) filter units of 2 M.G.D. capacity each:

(a) Filter sand and gravel;
(b) Filter floor or strain system;
(c) Lateral wash-water gutters;
(d) All necessary piping, valves, sluice gates, operating tables, gauges, motor-driven pumps and other auxiliary equipment.

All proposals must be made on the forms furnished by the City.

Each bidder must accompany his proposal with a satisfactory bond or certified check in the following amounts:

Contract No. 170, $10,000
Contract No. 205, 5,000

A surety bond in the amount of fifty (50) per cent of the amount of the contract will be required of the successful bidder on each contract.

Plans and specifications may be seen at the office of the Director, or copies may be obtained from the Bureau of Water Works Improvement, 102 E. Mill St., Akron, Ohio, upon deposit of ten dollars ($10.00), which sum will be refunded on return of these plans and specifications in good condition within ten days after the award of the contract.

The right is reserved to reject any or all bids.

E. A. ZEISLOFT,
Director of Public Service.
H. H. FROST,
Superintendent of Water Works.
G. GALE DIXON,
Engineer.

Bids: July 9.

Extension of Water-Works System

Collinsville, Ill.

Proposals will be received by the City Council of the city of Collinsville, Ill., at the Council Chamber until 8 o'clock p.m., the 9th day of July, A.D. 1920, for the furnishing of all material and labor necessary in the alteration, extension and repairs of the Municipal Waterworks System, as proposed and outlined by plans and specifications for each class of the work, which said plans are now on file in the office of the Clerk of said City where they may be inspected; and bidding blanks procured.

Each bidder will be required to accompany with his proposal a certified check in the amount of 10% of the amount of his bid, for the guarantee that he will enter into a contract and bond in event of the award of the contract.

Each bid must be submitted on the form furnished by the city which provides a means of bidding for each class of work separately; or the work as a whole.

The City of Collinsville, Ill., reserves the right to waive technicalities.

Contract to be awarded to lowest substantial bidder, subject to referendum vote of the electors of the City of Collinsville, Madison County, Illinois.

JAMES BAILEY,
City Clerk.

Bids: June 28.

Walls and Fireproofing Stairs

Trenton, N. J.

Sealed proposals for WALLS AND FIREPROOFING STAIRS at the NEW JERSEY STATE HOSPITAL, TRENTON, NEW JERSEY, will be received at the Department of Architecture, 142 West State St., Trenton, New Jersey, on Monday, the twenty-eighth day of June, 1920, at twelve-thirty o'clock (12:30 standard time) at which time they will be publicly opened and read.

Proposals must be sealed and addressed to the State Architect, and marked as above. Each proposal must be accompanied by a certified check drawn to the bidder's order and properly endorsed for an amount equal to at least five per cent (5%) of the amount of the bid.

The right to reject any or all bids is reserved.

The successful bidder, after contract is awarded will be required to furnish a satisfastory surety bond in the full amount of the contract price to guarantee the fulfillment of the conditions of his contract.

Plans and specifications may be obtained upon application to the Department of Architecture on deposit of $25.00, this amount to be returned to bidder upon return of plans and specifications in good condition.

FRANCIS H. BENT,
State Architect.

Bids: July 6.

Construction of Pavement

Charleston, S. C.

Sealed proposals will be received by the undersigned, until 12 m., Tuesday, July 6th, 1920, for 100,000 square yards, more or less of Sheet Asphalt Pavement.

The right is reserved to reject any or all bids

J. H. DINGLE,
City Engineer.

June 9th, 1920.

Bids: July 7.

Water Main Extensions

Dearborn, Mich.

Sealed bids will be received at the office of the Village Clerk, Dearborn, Mich., up to 8 p.m., of the 7th day of July, 1920.

The work consists of the furnishing of all material and labor to construct the following amount of cast iron water mains:

1,181 feet of 18-in.
121 feet of 16-in.
6,027 feet of 6-in., including all the necessary valves, hydrants, fittings, and making the necessary connections to the existing system, according to plans and specifications on file at the office of the Village Clerk and in the office of Clarence W. Hubbell, Consulting Engineer, 2348 Penobscot Bldg., Detroit, from whom copies may be obtained upon deposit of $5, which amount will be refunded upon the return of the plans and specifications in good conditions on or before July 17, 1920.

No bids will be received unless made on the blanks furnished and accompanied by a certified check for the sum of $2,000, payable to the Village of Dearborn, to insure the signing of contract and the furnishing of proper and acceptable bonds for the full amount of the contract price within ten days from the time of notification of the award of contract.

The right is reserved to reject any or all bids.

By order of the Village Commission.

FRED C. BEAMER,
Village Clerk

CLARENCE W. HUBBELL,
Consulting Engineer,
2348 Penobscot Bldg.,
Detroit, Mich.

Bids: July 2.

Highway Work

STATE COMMISSION OF HIGHWAYS

Albany, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p.m., on Friday, the 2nd day of July, 1920, for the reconstruction and resurfacing of the following:

ALBANY	ONE CONTRACT
COLUMBIA	ONE CONTRACT
DUTCHESS	ONE CONTRACT
FULTON	ONE CONTRACT
GREENE	ONE CONTRACT
LEWIS	ONE CONTRACT
ONEIDA	ONE CONTRACT
RENSSELAER	ONE CONTRACT
ULSTER	ONE CONTRACT
WARREN	ONE CONTRACT

Maps, plans, specifications, estimates and proposal forms may be obtained at the office of the Commission in Albany, N. Y., and at the office of the division engineers in whose division the roads to be reconstructed are located. The addresses of the division engineers and the counties of which they are in charge will be furnished upon request.

The especial attention of bidders is called to "General Information for Bidders" on the itemized proposal, specifications and contract agreement.

FREDERICK STUART GREENE,
Commissioner.
IRVING V. A. HUIE, Secretary.

Bids: July 6.

Street Improvement

Amsterdam, N. Y.

The Common Council of the City of Amsterdam, N. Y., will open bids at 8 p.m., July 6, 1920, for the construction of reinforced concrete pavement on Lyons and Van Der Veer Streets, such proposed work consisting of 5,200 sq.yd. of reinforced concrete pavement and 1,100 lin.ft. of concrete curbing.

Proposals must be accompanied by cash deposit, certified check or bond in the sum of one-tenth of the amount bid, but in no case less than $100 as security and conditions that the bidder will accept and execute a written contract therefore if the same is awarded to him.

The Common Council reserves the right to reject any or all bids or proposals.

Plans and specifications may be seen at the office of the Commissioner of Public Works.

THOS. J. HAZLETT,
City Clerk.

BURR M. STARK,
Commissioner of Public Works.

Bids: June 30.

Reconstruction of Road

Sea Bright, N. J.

Notice is hereby given that sealed bids will be received by The Board of Chosen Freeholders of the County of Monmouth for the reconstruction of the County Road or highway, known as Rumson Road and Ocean Avenue, in the Boroughs of Seabright and Monmouth Beach, in the County of Monmouth and State of New Jersey, and opened and read in public at the rooms of said board, Court House, Freehold, N. J., on Wednesday, June 30th, 1920, at 11 a.m.

Drawings and specifications for the proposed work prepared by J. Wesley Seaman, Civil Engineer under the supervision and direction of George D. Cooper, County Engineer, have been filed in the office of said J. Wesley Seaman, Civil Engineer at No. 192 Broadway, Long Branch, N. J., and may be inspected by prospective bidders during business hours. The standard proposal form is attached to the specifications, copies of which will be furnished on application to the last-named engineer.

Bids must be made on the standard proposal forms in the manner designated therein and required by the specifications; must be enclosed in sealed envelopes, bearing the name and address of the bidder and name of proposed work on the outside, addressed to The Board of Chosen Frehholders of the County of Monmouth and must be accompanied by a certified check for a sum equal to ten (10) per cent of the amount bid on the work, payable to the order of the Collector of the County of Monmouth and a surety company certificate stating that said surety company will provide the bidder with the required bond, and must be delivered at the place and on the hour above named.

The Board of Chosen Freeholders of the County of Monmouth reserves the right to reject any or all bids if deemed to the best interest of the County so to do.

By order of The Board of Chosen Freeholders of the County of Monmouth.

Attest: WILLIAM M. BERGEN,
Director.
C. E. CLOSE,
Clerk.

Freehold, N. J., June 9, 1920.

Bids: July 20.

Construction of School

Roselle Park, N. J.

Sealed proposals for the erection and completion of the Aldane School bounded by Lincoln Avenue, North, Myrtle Avenue and Faitoute Avenue, Roselle Park, will be received by the Board of Education of the Borough of Roselle Park, at a meeting to be held in the Robert Gordon School, Roselle Park, on the evening of July 20th, 1920.

Bids shall be made out on forms supplied for that purpose and shall be delivered to the Clerk of the Board, Mr. W. G. Elicker, at his residence or presented in person at the meeting to be held in the Robert Gordon School at the date above mentioned at 8 p.m. (Standard Time), and then opened in public meeting.

All work of General Construction is to be in accordance with Plans and Specifications prepared for the same by John Noble Pierson & Son, Architects, 173 Smith Street, Perth Amboy, N. J.

All work of Heating and Ventilating is to be in accordance with Plans and Specifications prapered for the same by Runyon and Carey, Consulting Engineers, 845 Broad Street, Newark, N. J.

The names of the proposed sub-contractors shall accompany the estimate on blanks provided for that purpose and shall be enclosed in the proper envelopes. No bid will be considered complete without the list of sub-contractors.

For the convenience and use of intending bidders plans will be loaned to them on and after June 28th, 1920, upon deposit of cash or certified check in the amount of Twenty ($20.00) Dollars.

Plans for the General Construction are to be obtained from the Architects.

Plans for the Heating and Ventilating are to be obtained from the Engineers.

All deposits will be returned when the plans are returned.

Plans will be issued until the supply is exhausted but at all times a set of General Construction plans will be on file at the offic of the Architects, a complete set of all plans with the Board of Education and a set of the Heating and Ventilating plans on file at the office of the Consulting Engineers. Contractors who are unable to obtain a set of plans and specifications may avail themselves of the privilege of estimating on these plans and specifications during business hours on any business day.

Before cash or certified check is returned a forfeit of 50 per cent of the deposit will be required from any bidder who fails to submit an estimate after receiving plans and specifications for this purpose.

Bids must be rendered separately for any or all branches as follows:

General Construction (comprising all):
Excavation;
Masonry;
Carpentry;
Steel and iron;
Painting and Roofing.
PLUMBING WORK
ELECTRICAL WORK
HEATING AND VENTILATING WORK

Each bid shall be accompanied by a certified check upon a National or State Bank, drawn to the order of the Board of Education of the Borough of Roselle Park in the various amounts as follows:

General construction	$1,000
Plumbing work	500
Electrical work	250
Heating and Ventilating work	750

binding the successful bidder to execute the contract if awarded to him.

The successful bidder will be required to furnish a satisfactory bond in the full amount of the contract price.

The Board reserves the right to reject any or all bids.

(Signed) J. S. WITEMEYER, Director.
W. J. ELICKER, District Clerk.

Bids: June 30

Reinforced Concrete Reservoir

Seymour, Ind.

The Seymour Water Company of Seymour, Indiana, will receive sealed proposals on the 30th day of June, 1920, for the construction of a reinforced concrete sedimentation reservoir to be used as a part of the water purification system of the Seymour Water Company.

Plans and specifications may be obtained by the payment of five dollars ($5.00) to the Secretary of the company, or at the office of the Consulting Engineer.

The Company reserves the right to reject any and all bids.

W. F. PETER,
Secretary.
LYNN FAULKNER,
President.
CHARLES H. HURD,
Consulting Engineer,
1405 Merchants' Bank Bldg.,
Indianapolis, Indiana.

Bids: July 7.

Refrigeration Plant

Dannemora, N. Y.

Sealed proposals for Refrigeration Plant and Cooling Rooms — Kitchen Building, Clinton Prison, Dannemora, N. Y., will be received by Charles F. Rattigan, Superintendent of State Prisons, Capitol, Albany, N. Y., until 12 o'clock noon on Wednesday, July 7, 1920, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed, and shall be accompanied by a certified check in the sum of five per cent (5%) of the amount of the proposal. The contractor to whom the award is made will be required to furnish surety company bond in the sum of fifty per cent (50%) of the amount of contract within thirty (30) days after official notice of award of contract and in accordance with the terms of Specification No. 3554.

The right is reserved to reject any or all bids.

Drawings and specifications may be examined and inspected at the Office of the Superintendent of State Prisons, Capitol, Albany, N. Y.; at the Office of the Warden of Clinton Prison, Dannemora, N. Y.; at the New York Office of the Department of Architecture, Room 618 Hall of Records Building, and at the Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications and blank forms of proposals may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon reasonable notice to and in the discretion of the State Architect, L. F. Pilcher, Capitol, Albany, N. Y.

Dated: June 18, 1920.

Bids: July 7.

Drainage Work

Montezuma, Ia.

In Bear Creek Drainage District No. 2, Poweshiek County, Iowa.

Notice is hereby given that in pursuance of an order of the Board of Supervisors of Poweshiek County, Iowa, made on the 8th day of June A. D., 1920, sealed bids will be received by the undersigned for said Board up to 12 o'clock M. noon, on the 7th day of July A. D. 1920, for construction of Drainage Improvements in Bear Creek Drainage District No. 2 of Poweshiek County, Iowa, in accordance with approved plans, profile, specifications, instructions to contractors blank form of bids, contract and bond therefor, all on file in my office.

Said improvement involves the straightening of the Bear Creek for a distance of about two and one-half (2½) miles, by continuous new channel with an average depth of eleven (11) feet, thirty-five (35) foot and forty (40) foot bottom, one-half foot to one foot slopes, and five (5) foot berms, and also Cub Creek Lateral leading into same.

Main channel involves the removal of approximately 211,420 cubic yards of earth and Cub Creek Lateral involves the removal of approximately 28,023 cubic yards of earth.

Monthly estimate rendered for 80% of work completed and paid in cash by County Treasurer and total in cash on completion and acceptance of each section.

Work of excavation shall commence on or before Aug. 15, 1920, and be completed on or before Dec. 1, 1921.

Instructions and Specifications furnished on application.

C. H. YOUNG, Chief Engineer,
Central States Engineering Co.,
Muscatine, Iowa.
W. C. McKEE, County Auditor,
Poweshiek County, Montezuma, Ia.

Bids: June 28.

Construction of Pavement

Tarkio, Mo.

The City Clerk of Tarkio, Atchison Co., Mo., will receive bids on approximately 1,600 sq.yd. of pavement, with Tarvia, Concrete or brick. Will receive bids until 8:30 p.m., Monday June 28th, 1920.

JOHN H. CAPP, City Clerk.

Bids: July 9

Street Paving

Akron, Ohio

Sealed proposals will be received by the Director of Public Service until twelve noon, Central Standard Time, July 9th, 1920, for GRADING, PAVING and CEMENT WALKS on five streets and GRADING and WALKS on twelve streets.

The approximate principal items are:

38,000 cu.yds. grading,
17,000 sq.yds. paving,
200,000 sq.ft. cement sidewalks.

A certified check is required. Plans and estimates may be seen at the office of the Engineer, Bureau of Highways, or will be sent to any address upon receipt of $20.00 which will be returned in exchange for the plans not later than July 16th, 1920.

E. A. ZEISLOFT,
Director of Public Service.
E. A. KEMMLER, Engineer,
Bureau of Highways.

Bids: July 7.

Drainage Work

Montezuma, Ia.

In Bear Creek Drainage District No. 1, Poweshiek County, Iowa.

Notice is hereby given that in pursuance of an order of the Board of Supervisors of Poweshiek County, Iowa, made on the 8th day of June A. D., 1920, sealed bids will be received by the undersigned for said Board up to 12 o'clock M. noon, on the 7th day of July A. D. 1920, for construction of Drainage Improvements in Bear Creek Drainage District No. 1 of Poweshiek County, Iowa, in accordance with approved plans, profile, specifications, instructions to contractors blank form of bids, contract and bond therefor, all on file in my office.

Said improvement involves the straightening of the Bear Creek for a distance of about eleven and 72/100 (11.72) miles by a continuous new channel with a depth of eleven (11) to nine (9) feet, one-half (½) foot to one (1) foot slopes, and five (5) foot berms, and also Rock Creek Lateral 18′ bottom, Little Bear Creek Lateral 16′ bottom and Stony Creek Lateral 8′ bottom.

Main channel involves the removal of approximately 410,655 cubic yards of earth. Rock Creek Lateral approimately 41,330 cubic yards of earth, Little Bear Creek Lateral approximately 21,330 cubic yards of earth, and Stony Creek Lateral approximately 3,645 cubic yards of earth.

Monthly estimate rendered for 80% of work completed and paid in cash by County Treasurer and total in cash on completion and acceptance of each section.

Work of excavation shall commence on or before Aug. 15, 1920, and be completed Dec. 1, 1921.

Instructions and Specifications furnished on application to

C. H. YOUNG, Chief Engineer,
Central States Engineering Co.,
Muscatine, Iowa.
W. C. MCKEE, County Auditor,
Poweshick County, Montezuma, Ia.

OFFICIAL PROPOSALS

Bids: July 7

Reconstruction of Road

STATE OF RHODE ISLAND
STATE BOARD OF PUBLIC ROADS
Providence, R. I.

Sealed proposals for the reconstruction under the provisions of the Federal Aid Road Act of a section of State Highway in the Town of Tiverton beginning 1,000 feet south of Nanaquaket Bridge and extending southerly upon the Sakonnet Point road for a distance of two miles, will be received by the State Board of Public Roads at its office, State House, Providence, R. I., until 12 m. on Wednesday, July 7, 1920, at which time they will be opened and read in public.

The principal estimated quantities are as follows:

Clearing and grubbing	3.5 acres
Earth excavation	7,600 cu.yds.
Ledge excavation	400 cu.yds.
Stone foundation	7,300 cu.yds.
Gravel foundation	1,100 cu.yds.
Pipe culverts	1,330 lin.ft.
Catch basins	9
Concrete masonry	90 cu.yds.
Crushed stone (imported)	6,500 tons
Hauling, heating and applying bitumen (penetration method)	59,000 gals.

Bids must be made upon blank forms to be furnished by the Board.

No bids will be accepted unless accompanied by a certified check for the sum of $200.00, payable to the State of Rhode Island.

The Board reserves the right to reject any and all bids and to give preference to towns or cities in accordance with Section 5 of Chapter 84 of the General Laws.

Plans may be examined and specifications and bidding blanks may be obtained at the office of the State Board of Public Roads, State House, Providence, R. I., on and after Monday, June 28th, 1920, every week day (except holidays and Saturdays) between the hours of 9 a.m. and 5 p.m., Saturdays 9 a.m. to 12 m.

STATE BOARD OF PUBLIC ROADS.
Abram L. Atwood,
Benjamin F. Robinson,
Frank Cole,
Alton Head,
J. Henry Woodard.

Bids: June 30.

Artesian Well

Central Islip, N. Y.

Sealed proposals for Artesian Well for Additional Water Supply, South Colony Power Plant, at the Central Islip State Hospital, Central Islip, N. Y., will be received by the State Hospital Commission, Captiol, Albany, N. Y., until 3 o'clock p.m., on Wednesday, June 30, 1920, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed, and shall be accompanied by a certified check in the sum of five per cent (5%) of the amount of the proposal. The contractor to whom the award is made will be required to furnish surety company bond in the sum of fifty per cent (50%) of the amount of contract within (30) days after official notice of award of contract and in accordance with the terms of Specification No. 3523. The right is reserved to reject any or all bids. Drawings, specifications and blank forms of proposal may be consulted at the Central Islip State Hospital, Central Islip, N. Y., at the New York Office of the Department of Architecture, Room 618, Hall of Records Building, and at the Department of Architecture, Capitol, Albany, N. Y. Drawings, specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon reasonable notice to and in the discretion of the State Architect, L. F. PILCHER, Capitol, Albany, N. Y.

Bids: July 2

Street Improvement

Winchester, Ky.

The Board of Council of the City of Winchester, Ky., will, on July 2nd, 1920, at 8 o'clock p.m., in its Council Chamber, receive sealed bids for the improvement of about 75,000 square yards of streets, to be constructed of Asphalt, Vitrified Brick or Concrete, according to the plans and specifications therefor on file in the office of G. T. Horine, City Engineer.

The Council reserves the right to reject any and all bids.

STREET COMMITTEE
Of the City of Winchester, Ky.

OFFICIAL PROPOSALS

Bids: July 6

Road Work

STATE OF MARYLAND
STATE ROADS COMMISSION
Baltimore, Md.

Sealed proposals for building one section of State Highway, as follows: Anne Arundel Contract No. AA-15-A, Federal Aid No. 34.—One section of State Highway from the State Road near Owensville toward Shadyside, for a distance of 6.00 miles, GRAVEL, will be received by the State Roads Commission, at its offices, 601 Garrett Building, Baltimore, Maryland, until 12 m. on the 6th day of July, 1920, at which time and place they will be publicly opened and read.

Bids must be made upon the blank proposal form which, with specifications and plans, will be furnished by the Commission upon application and cash payment of $1.00, as hereafter no charges will be permitted.

No bids will be received unless accompanied by a certified check for the sum of Five Hundred Dollars ($500), payable to the State Roads Commission.

The successful bidder will be required to give bond, and comply with the Acts of the General Assembly of Maryland, respecting contracts.

The Commission reserves the right to reject any and all bids.

By order of the State Roads Commission this 19th day of June, 1920.

J. N. MACKALL, Chairman.
CLYDE H. WILSON, Secretary.

Bids: July 14

Reconstruction of Road

STATE OF MARYLAND
STATE ROADS COMMISSION
Baltimore, Md.

Sealed proposals for building the following: Baltimore City Contract BC-37.—Paving Frederick Road from Old City Line to New City Line 1.45 miles of sheet asphalt to be laid on reconstructed stone base, will be received by the State Roads Commission, at its offices, 601 Garrett Building, Baltimore, Maryland, until 12 m. on the 14th day of July, 1920, at which time and place they will be publicly opened and read.

Bids must be made upon the blank proposal form which, with specifications and plans, will be furnished by the Commission upon application and cash payment of $1.00, as hereafter no charges will be permitted.

No bids will be received unless accompanied by a certified check for the sum of Five Hundred Dollars ($500), payable to the State Roads Commission.

The successful bidder will be required to give bond, and comply with the Acts of the General Assembly of Maryland, respecting contracts.

The Commission reserves the right to reject any and all bids.

By order of the State Roads Commission this 19th day of June, 1920.

J. N. MACKALL, Chairman.
CLYDE H. WILSON, Secretary.

Bids: July 12

Paving

STATE OF MARYLAND
STATE ROADS COMMISSION
Baltimore, Md.

Sealed proposals for building the following: Baltimore City Contract BC-36.—Paving Harford Road from Old City Line to New City Line, 2.75 miles of sheet asphalt to be laid on reconstructed stone base, will be received by the State Roads Commission, at its offices, 601 Garrett Building, Baltimore, Maryland, until 12 m. on the 12th day of July, 1920, at which time and place they will be publicly opened and read.

Bids must be made upon the blank proposal form which, with specifications and plans, will be furnished by the Commission upon application and cash payment of $1.00, as hereafter no charges will be permitted.

No bids will be received unless accompanied by a certified check for the sum of Five Hundred Dollars ($500), payable to the State Roads Commission.

The successful bidder will be required to give bond, and comply with the Acts of the General Assembly of Maryland, respecting contracts.

The Commission reserves the right to reject any and all bids.

By order of the State Roads Commission this 19th day of June, 1920.

J. N. MACKALL, Chairman.
CLYDE H. WILSON, Secretary.

OFFICIAL PROPOSALS

Bids: July 6

Construction of Drainage

DISTRICT

Paducah, Ky

McCracken County Board of Drainage Commissioners will at the hour of ten (10) a.m., July 6th, receive bids, at its office No. 1017 City National Building, Paducah Kentucky, for the construction of the Mayfield Drainage District No. 1.

The Board of Drainage Commissioners reserves the right to reject any and all bids.

The successful bidder will be required to execute bond satisfactory to the Board

Engineer's Information for Bidders furnished upon request, and, a payment of fee of $10.00, to be refunded upon filing of the bids by the depositor.

McCracken County
Drainage Commissioners.
by JNO. W. FRY, Pres

Bids: July 12

Construction of Steel Spans

Carson City, Nev

Sealed proposals will be received by the undersigned until 2 o'clock p.m., July 12, 1920, for the construction of one 126 ft Steel Pratt Truss Highway Span on concrete abutments over the Humboldt River in Eureka County.

Plans may be examined and forms of proposal, contract and specifications secured at office of undersigned; may also be examined at the county clerk's office in Eureka. Cash deposit of $15.00 with the undersigned required for copy of plans, which will be refunded on their return in good condition. Bids must be on proposal form of Highway Department accompanied by certified check in the amount of 5 per cent of bid. Right is reserved to reject any or all bids.

C. C. COTTRELL
State Highway Engineer

U. S. GOVERNMENT

Bids: July 2.

PROPOSALS FOR BULKHEAD CONSTRUCTION, ETC. United States Engineer Office, Norfolk, Va. Sealed proposals will be received here until 12 m., July 2, 1920, and then opened, for constructing a bulkhead on the Craney Island Flats, Norfolk, Va., and furnishing and placing riprap stone on an existing bulkhead. Further information on application.

Bids: July 12

OFFICE OF THE COMMISSIONERS Washington, D. C., June 19, 1920.—Sealed proposals will be received at this office, Room 509, District Building, until 2 o'clock p.m., Monday, July 12, 1920, for making repairs to asphalt pavements for a one-year period, and for a two-year period beginning July 1, 1920. Forms of proposal, specifications, and necessary information may be obtained at the office of the Chief Clerk, Engineer Department, Room 427, District Building. LOUIS BROWNLOW, CHAS. W. KUTZ, Commissioners, D. C.

Bids: July 12

OFFICE OF THE COMMISSIONERS Washington, D. C., June 19, 1920.—Sealed proposals will be received at this office, Room 509, District Building, until 2 o'clock p.m., Monday, July 12, 1920, for laying sheet asphalt pavements aggregating about 65,000 square yards. Forms of proposal, specifications, and necessary information may be obtained at the office of the Chief Clerk, Engineer Department, Room 427, District Building. LOUIS BROWNLOW, CHAS. W. KUTZ, Commissioners, D. C.

Bids: July 15.

U. S. ENGINEER OFFICE, Pittsburgh, Pa.—Sealed proposals will be received here until 12 noon (Eastern time), July 15, 1920, and then opened, for furnishing and delivering gate and valve-operating machinery for Emsworth dam, Ohio River. Further information on application.

Bids: July 24.

U. S. ENGINEER OFFICE, Room 710 Army Building, 39 Whitehall Street, New York, N. Y.—Sealed proposals will be received here until 12 m., July 24, 1920, and then opened, for dredging in Mattituck Harbor, N. Y. Further information on application.

U. S. GOVERNMENT

Bids: June 25.

SEALED PROPOSALS will be received at the office of the Chief of Construction Division, Room 1-241, 7th and "B" Sts., S.W., Washington, D. C., until two o'clock, June 25, 1920, and then opened for miscellaneous work at Langley Field, Hampton, Va., miscellaneous buildings, roads, sewers, heating plant, etc. Plans and specifications may be obtained on application by depositing ten dollars with the Chief of Construction Division, Washington, D. C., or the Constructing Quartermaster, Langley Field, Hampton, Va.

Bids: June 26.

PROPOSALS FOR SUPPLIES—Office Utilities Officer, Ward No. 1, Walter Reed U. S. Army General Hospital, Takoma Park, D. C. Sealed proposals in duplicate will be received here until 11 a.m., June 26, 1920, and then opened for furnishing building materials and supplies. Further information furnished on application.

Bids: June 26.

PROPOSALS FOR HOSPITAL CONSTRUCTION. Office Utilities Officer, Ward No. 1, Walter Reed U. S. Army General Hospital, Takoma, Park, D. C. Sealed proposals in duplicate will be received here until 11 a.m., June 26, 1920, and then opened, for furnishing labor and material for installation of laundry machinery. Further information on application.

Bids: July 8.

UNITED STATES ENGINEER OFFICE, Louisville, Ky. Sealed proposals for furnishing and delivering one steel dump scow will be received at this office until 12 noon (Central Time), July 8, 1920, and then opened. Information on application.

Bids: June 30.

UNITED STATES ENGINEER OFFICE. Customhouse, Norfolk, Va. Sealed proposals will be received here until 12 o'clock noon, June 30, 1920, and then opened, for dredging upon the Inland Waterway from Norfolk, Va., to Beaufort, N. C. Further information on application.

Bids: July 8.

PROPOSALS FOR RUBBER HOSE.—Office, Mississippi River Commission, 1st and 2nd Districts, Custom House, Memphis, Tenn.—Sealed proposals for furnishing and delivering Rubber Hose will be received at this office until 11 a.m., July 8, 1920, and then opened. Further information on application.

U. S. GOVERNMENT

Bids: June 26.

PROPOSALS FOR HOSPITAL CONSTRUCTION. Office Utilities Officer, Ward No. 1, Walter Reed U. S. Army General Hospital, Takoma Park, D. C. Sealed proposals in duplicate will be received here until 11 a.m., June 26, 1920, and then opened, for furnishing labor and material for roads, walks, drainage and grading. Further information furnished on application.

Bids: July 14.

PROPOSALS FOR U. S. DREDGE SABINE.—U. S. Engineer Office, Galveston, Texas.—Sealed proposals for the purchase of the seagoing hopper dredge Sabine will be received at this office until noon, July 14, 1920, and then publicly opened. Blank bids and description of dredge can be obtained at U. S. Engineer Office, Galveston, Texas. Dredge can be examined at Beaumont, Texas.

Bids: June 28.

PROPOSALS FOR DREDGE, ETC. U. S. Engineer Office, Wilmington, N. C.—Sealed proposals will be received here until 2 p.m., June 28, 1920, and then opened for the purchase of the clamshell dredge HERCULES and steam launch MERCUR. Information on application.

Bids: July 15.

PROPOSALS FOR DREDGING.—U. S. Engr. Office, Wilmington, Del. Sealed proposals will be received here until 11 a.m., July 15, 1920, and then opened, for dredging waterway between Rehoboth Bay and Delaware Bay (Lewes Canal), Delaware. Further information on application

U. S. GOVERNMENT

Bids: July 1.

U. S. ENGINEER OFFICE, Room 71 Army Building, 39 Whitehall Street, New York, N. Y.—Sealed proposals will be received here until 12 m., July 1, 1920, and then opened, for dredging in East Chester Creek, N. Y. Further information on application.

Bids: July 3.

UNITED STATES ENGINEER OFFICE, Louisville, Ky., June 3, 1920. Sealed proposals for furnishing and delivering Structural Steel, Castings, etc., for Lock No. 41 Ohio River, will be received at this office until 12 o'clock noon (Central Time), July 3, 1920, and then opened. Information on application.

Bids: July 1.

PROPOSALS FOR MANILA ROPE. Office, Mississippi River Commission, 1st and 2nd Districts, Custom House, Memphis, Tenn.—Sealed proposals will be received here until 11 a.m., July 1, 1920, and then opened, for furnishing and delivering 70,000 lb. Manila rope. Further information on application.

Bids: July 15.

PROPOSALS FOR GALVANIZED WIRE, WIRE STRAND, STAPLES AND WIRE ROPE CLIPS.—Office, Mississippi River Commission, 1st and 2nd Districts, Custom House, Memphis, Tenn.—Sealed proposals for furnishing and delivering 790,000 lbs. galvanized wire, wire strand, and staples, and 30,000 wire rope clips, will be received at this office until 11 a.m., July 15, 1920, and then opened. Further information on application.

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Insurance Underwriter

¶It is traditional that Wall Street is far more responsive to news of an adverse nature than to good news. ¶It is common knowledge that under ordinary conditions, bad news will depress market prices farther than good news will boost them the opposite direction. ¶When you make application for a Contract Bond, the underwriter will go a long way and to much trouble to investigate some adverse condition that may not really exist, but he will not go out of his way to see if any good points have been overlooked. ¶That is the work of your insurance broker. It is his duty to see that your case is properly prepared and presented in such a way that every favorable point is placed to advantage. ¶Unless you employ a broker who specializes in Contract Bonds you have no assurance that the work will be properly done. ¶Why assume this risk when the requirements for Contract Bonds are more stringent than ever before? ¶The real service costs no more than the other sort. ¶Swart is an expert in Contract Bonds and an experienced engineer as well. ¶*Let's get acquainted.*

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POSITIONS VACANT

EMPLOYMENT

POSITIONS WANTED

WANTED

Structural Steel Draftsmen

for detailing steel for mill and office buildings. State age, experience, salary and how soon you can report.

F. L. HEUGHES & CO., INC.
1029 Lyell Ave., Rochester, New York

WANTED

STRUCTURAL DRAFTSMEN

Apply at once stating age, training, experience, nationality, salary expected at start and date can report.

NASHVILLE BRIDGE CO.
Nashville, Tenn.

MEN FINDERS

Interstate — Foreign Service

STRUCTURAL DRAFTSMAN

Bridge and building design, Manila, P. I., two-year contract transportation both ways! Wire giving age, data, experience. **$3,000** per annum.

ABILITORS

INTERSTATE CO.
Kittredge Bldg., Denver, Colo., U. S. A.
Before It's Service, It's Will—It's Devotion.

DRAFTSMAN

Experienced and thoroughly familiar in raw sugar and refinery work, wanted at once for position in Havana, Cuba. Willing to be away two years.

Write fully stating experience, salary, etc.

P501—Eng. News-Record
36th St., at 10th Ave., New York City

POSITIONS VACANT

ARCHITECTURAL draftsmen and designers (4). Apply, T. C. Desmond Company, 105 Newington Ave., Hartford, Conn.

ARCHITECT'S assistant wanted for railroad valuation work. Location New York. Give age, education, nationality, experience and salary desired. P-558 Eng. News-Record.

BOOKKEEPER wanted with experience, familiar with enginering and construction accounting preferred. Apply in own handwriting, giving experience, salary required and how soon available. P-552, Eng. News-Record.

BUILDING construction superintendents (2) familiar with building of small houses in large developments. Also carpenter, brick layer, concrete and grading foremen; long job. Apply, T. C. Desmond Company, 105 Newington Ave., Hartford, Conn.

BUILDING superintendent wanted to take full charge of concrete skeleton construction and trim out complete. Location, Florida. State age, list of work directed, references, and salary wanted. Address, P. O. Box 371, Jacksonville, Fla.

CHEMIST (male) wanted for the Panama Canal; must be graduate in chemistry or sanitary engineering and have had satisfactory experience in water purification work; must be an American citizen under 50 years and in good health; entrance salary $181 month, increased to $200 month after three months' satisfactory service; free steamship transportation to Isthmus. For further particulars write "Chief of Office, The Panama Canal, Washington, D. C."

CONSTRUCTION superintendent—Enlarging chemical work in Baltimore, experience required in erecting brick, steel and timber structural work, reinforced concrete pits, etc., installation of drying, conveying and transmission machinery, piping, motors and general plant equipments; must be able to work accurately to drawings, understand handling of men and keeping of records; state experience, references, salary desired and when available first letter. Mutual Chemical Co. of America, 55 John St., N. Y. City.

DRAFTSMEN and estimators by consulting and erecting engineers, cane and beet sugar industry; location, New York City; excellent company with world-wide connections; drafting room conditions good; only exceptional men need apply; will consider only mechanical engineers experienced sugar industry. Apply Honolulu Iron Works Company, Woolworth Bldg., New York City.

DETAILERS wanted for structural steel work. Apply, giving particulars, to The Berlin Construction Co., Inc., Berlin, Conn.

POSITIONS VACANT

DRAFTSMEN wanted for the Panama Canal—1 electrical draftsman familiar with fire control work of coast artillery; 1 marine hull draftsman thoroughly experienced in general ship construction and repairs, capable of laying out and developing work from specifications; 2 draftsmen mechanical engineering graduates class 1920 and 2 draftsmen, naval architecture, graduate class 1920. Applicants must be American citizens (final papers) under 50 years of age, in good health; free steamship transportation from New York or New Orleans, salary beginning date of sailing; no civil service examination required. Write "Chief of Office, The Panama Canal, Washington, D. C."

DRAFTSMAN wanted immediately on plans for pulp mill, familiar with piping layout and reinforced concrete design; good salary, permanent position to right man. State salary wanted, full experience, education and give references in first letter. Single men only. Kipawa Company Limited, Mattawa, Ont. Canada.

DRAFTSMEN—Experienced structural detailers wanted, location, eastern Pa. Permanent position. State experience, age, salary expected and when available in first letter. P-193, Eng. News-Record, Real Estate Trust Bldg., Philadelphia.

ENGINEERS and draftsmen familiar with coal handling and tipple equipment and structures wanted. Fairmont Mining Machinery Co., Fairmont, W. Va.

ENGINEER computer wanted on bridge and building valuation work with railroad company. Location New York. Give age, education, nationality, experience and salary desired. P-559, Eng. News-Record.

DESIGNING draftsman, structural, experienced on power plants, coal handling structures and industrial buildings. Henry R. Kent & Company, Rutherford, New Jersey.

Notice to Advertisers

Owing to the coming holiday, the Searchlight Section of the July 1 issue will close for press Monday, June 28. All changes of copy must be in our hands by Saturday, June 26.

Mail your copy as early as possible to insure its appearing in the issue desired.

Mechanical and Structural DRAFTSMEN

Permanent positions are offered with exceptional opportunity for advancement. Prefer men with experience in elevating and conveying machinery. State age, education, experience and salary expected.

GIFFORD WOOD CO., Hudson, N. Y.

POSITIONS VACANT

ENGINEERS and foremen wanted by H. V. Campbell, formerly Manila Railroad and 20th Engineers, for construction in the tropics; allow two months for answer. P-551, Eng. News-Record.

EXPERIENCED draftsmen wanted on townsite development work to assist in preparation of maps and profiles, computations of surveys. Rapid clean workmen and good letterers desired. Work near Maryville, Tennessee, in connection with large industrial development. Send full statement of experience and salary desired. Address, Box 391, Aluminum Company of America, Maryville, Tenn.

EXPERIENCED draftsmen wanted for structural steel buildings. Apply by mail only, giving age, nationality, education, experience and salary expected. Post & McCord, 101 Park Ave., New York.

FIRST class walking boss wanted, who thoroughly understands the laying and maintenance of an industrial railroad working on concrete road. Give experience, reference and salary desired in first letter. Rosoff Engineering Co., Inc., Whitney Point, N. Y.

GENERAL superintendent wanted. Competent of supervising all contracts, which include two reinforced concrete buildings and one theatre of half a million dollars each. Good salary for the right person. P-494, Eng. News-Record.

GRADING superintendent for highway work in West Virginia. One thoroughly experienced in steam shovel and scraper work in building highways. Give full details as to age, experience, and salary expected. P-546, Eng. News-Record, Leader-News Bldg., Cleveland.

HIGH-CLASS mechanical draftsman wanted for refinery design and detailing; neat accurate and experienced, preferably in oil, piping or boilershop work; also engineer with several years' experience and ability in design. Give full details, education, experience and salary. Good opportunity. Apartado No. 162, Tampico, Mexico.

INSTRUCTOR in civil engineering department for school year beginning Sept. 1st; state qualifications, education, experience, age, minimum salary first year of nine months; furnish photographs and references. Clark E. Mickey, Chairman Civil Engineering Dept., University of Nebraska, Lincoln, Nebraska.

MAN of experience, building construction, in handling of all matters pertaining to estimating, buying, negotiations, expediting, office management, an executive assistant, capable of development, to take complete charge of office organization. Must be an organizer with force and character. Write in detail; minimum salary. P-497, Eng. News-Record.

OFFICE engineer wanted, who is familiar with designing and checking structural steel for office buildings, mill buildings, miscellaneous iron, etc. Also knows how to manage the office for results. State age, experience in detail, how soon available and salary expected in first letter. Location Dallas, Texas. P-480, Eng. News-Record, Old Colony Bldg., Chicago.

SEVERAL first-class checkers on structural steel wanted. Permanent position for right men. Only first-class men need apply. Indiana Bridge Co., Muncie, Ind.

STRUCTURAL detailer and checker wanted: Permanent position to the right party and an opportunity to advance to our sales department. P-541, Eng. News-Record, Leader-News Bldg., Cleveland.

SEWER foreman wanted: Only one able to get results need apply. Apply, R. F. Relly Contracting Co., Paulsboro, N. J.

STRUCTURAL steel draftsmen and checkers with experience in bridge and structural work. State age, experience, nationality and salary expected. Permanent positions for experienced men. Anthracite Bridge Company, Scranton, Pa.

STRUCTURAL detailers and checkers familiar with shop details for building work. State age, experience, nationality, and salary expected. New England Structural Company, Everett, Mass.

POSITIONS VACANT

TEACHERS wanted: Men for college positions, eachers of electrical and civil engineering, September next. Salaries $1,800 to $2,500. Special terms. The Interstate Teachers' Agency, Macheca Building, New Orleans, La.

TECHNICALLY trained engineers wanted by firm of Water Works Engineers, specializing in waste surveys. Salary—$150.00 to $200.00, depending on experience and ability. Write for interview. P-560, Eng. News-Record.

POSITIONS WANTED

Mechanical and Electrical

ELECTRICAL engineer, thoroughly experienced designer industrial electric plants, distribution systems, and complete electrical equipment. PW-405, Eng. News-Record.

Civil Engineer

CIVIL engineer, eighteen years' experience in railroad location, construction, maintenance, valuation, surveys, land titles, real estate, I. C. C. classification, etc., desires to make other connection in executive position with railroad or industrial concern as chief engineer, in charge of land department, or any position am qualified for. Salary commensurate with duties. PW-350, Eng. News-Record, Real Estate Trust Bldg., Philadelphia.

CIVIL engineer, technical graduate with six years' varied experience, desires a permanent position in or near New York City, where there are good opportunities for advancement. Salary desired $250 per month. Engineer, 533 Sunset Ave., Rocky Mount, N. C.

CONSTRUCTION crew, consisting of engineers, mechanical and civil, steel workers, riggers, carpenters, concrete, clerical and executive men; first-class men of long experience in construction work wish to connect with large construction company or builder, doing work in South America, Europe or Alaska; preferably in South America. Can handle any proposition in construction from start to completion. Want to hear companies where mechanical experience, education and executive ability is needed and rewarded. Address, PW-365, Eng. News-Record, Old Colony Bldg., Chicago.

FIELD engineer; practical and technical pioneer, woodsman, mountaineer, miner, rancher, mechanic; builder of roads, surface and aerial transportation lines, irrigation works, etc.; civil engineer, member Am. Soc. C. E. and other technical societies; recently Captain Engineers, A.E.F., France; desires position as development engineer for live community or development corporation of standing. San Francisco interview after satisfactory credentials. PW-388 Eng. News-Record, Rialto Bldg., San Francisco.

EMPLOYMENT AGENCIES

DESIGN engineers and junior draftsmen and transitmen required for various large construction and permanent maintenance details. Heating, power plant, factory, hydraulic and structural work. Fastest direct service, preliminary expenses assumed. American Service Company, Pittsburgh, Pa.

Employment Service.

EXECUTIVES qualified for salaries of $2,500 to $25,000 and upwards, are invited to communicate in strict confidence with the undersigned, who will conduct preliminary negotiations for such positions. The procedure used is peculiar to this service, differing essentially from all others; and is constructive and initiative; applied individually; and in no way jeopardizing present connections. Established 1910. Send name and address only for particulars. R. W. Bixby, Inc., 304 Lockwood Building, Buffalo, New York.

Confidential Employment Service
FOR HIGH GRADE MEN
Executives, Engineers, Superintendents, Draftsmen and Commercial Men.
Write in confidence for full particulars
H. H. HARRISON & CO.
19 So. La Salle St., Chicago.

WANTED

Engineer, Building and Equipment Expert

We contemplate going into the enlargement of the buildings and equipment of three of our factories, at an early date; and desire to secure the services of a first-class engineer and building expert to make the survey of same, and report to us as soon as practicable. Two of these factories are located in Birmingham, Alabama, and one in Atlanta, Georgia. It is our desire to secure the services of one who is thoroughly capable of doing this work. And, we would appreciate anyone who is capable to undertake this work to write to us at once, giving references as to past experience.

CONTINENTAL GIN CO.
R. S. Munger, Vice President
Manufacturers of Cotton Ginning Machinery
Birmingham, Alabama

WANTED

A Young, Well-Trained Ambitious Engineer

To act as instructor in Estimating, Practical Mathematics, Strength of Materials in a technical school near Boston. From two to four years experience after graduation from college required. Some teaching experience desirable but not essential. An excellent opening with superior chances of advancement for the right young man. Please apply describing in detail age, nationality, general education and technical training and experience. Address Professor of Engineering, P. O. Box 3616, Boston, Mass.

Community Leaders Are Needed

to fill important positions with Chambers of Commerce and other civic organizations. The man who combines ability as an organizer with experience in municipal engineering has a fine opportunity for a successful career. Knowledge of the technique of running a Chamber of Commerce office can be gained at the Summer School of Community Leadership, to be held in Madison, Wis., August 19-26. Prospectus on application.

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We require the services of an engineer or assistant trained in large company, desirous of becoming PURCHASING AGENT for smaller company. Position offers unlimited opportunities and good salary.

Applicant must be acquainted with Philadelphia market and experienced in the purchase of materials and supplies for Foundry, Machine and Boiler Shops.

Reply by mail giving full particulars as to experience, age, education and initial salary. B. J. S., Room 604, 95 Liberty Street, New York City.

WANTED

Structural Draftsmen and Checkers

CANTON BRIDGE COMPANY
Belden Ave. & 10th St. N. E., Canton, Ohio

POSITIONS WANTED

CIVIL engineer, age 34, graduate of prominent Eastern technical school; eight years' experience in construction and maintenance of way departments of large Eastern railway system; also three years in charge of industrial plant layout and construction. Desires position with railroad company, industrial or contracting concerns. PW-433, Eng. News-Record, Real Estate Trust Bldg., Philadelphia.

GRADUATE engineer, M. Am. Soc. C. E., 28 years' varied experience; has had charge of office and field forces on large work, mainly water supply, canal and dam construction; minimum salary, $3,000. PW-375, Eng. News-Record, Real Estate Trust Bldg., Philadelphia.

ENGINEER graduate (M. I. T.) associate member American Society Civil Engineers, six years' construction, two years' office, New York district; one month's notice; salary, $300. PW-212, Eng. News-Record.

CIVIL engineer, graduate, seeks engagement in hydraulic field. Eleven years on barge canal construction. P. O. Box 55, Melrose, N. Y.

GRADUATE engineer, M. Am. Soc. C. E., 28 years' varied experience; has had charge of office and field forces on large work, mainly water supply, canal and dam construction; minimum salary, $3,000. PW-375, Eng. News-Record.

YOUNG C. E. graduate, having several years varied field experience, desires position in the Orient. PW-485, Eng. News-Record.

CIVIL engineer, graduate, 12 years' experience, design and construction, docks, sewers, railroads, subways, power and industrial plants, hydro-electric development. PW-472, Eng. News-Record.

POSITIONS WANTED

CIVIL engineer, experienced in structural design and field work, also roads and water supply. Graduate Rensselaer Polytechnic. PW-471, Eng. News-Record.

CIVIL engineer, 30, married, 8 years' experience as resident engineer, county engineer, foreman, superintendent of construction on large expenditures on modern pavements, waterworks and sewerage, railroads, bridges, etc. Desires location in South or West, preferably Texas, with engineering or contracting firms. Would like to become member of firm. Apply, Engineer, P. O. Box 220, Goldsboro, N. C

HOUSING manager, graduate civil engineer, age 32, reliable, tactful, resourceful, for 3 years assistant to manager of large industrial housing project; wants position as manager or assistant manager of similar development. Salary $300. PW-493, Eng. News-Record, Old Colony Bldg., Chicago.

CONSTRUCTION engineer, 6 years industrial and hydro-electric plants, concrete, highways, water supply, sanitation. Graduate C. E., thoroughly practical, age 28, married. Present position resident engineer, paving. Want position maintenance industrial plant, southern location. Minimum salary $175. One month's notice. PW-491, Eng. News-Record.

CIVIL engineer, college graduate, with 6 years' varied experienced in city surveys, sewer and paving construction, highway surveys, good instrumentman and draftsman, desires position with construction firm. J. Lindler, 9B Irving Ave., Atlantic City, N. J.

CIVIL engineer, graduate; five years' field and office experience on the design and construction of subways, buildings, highways; location near New York. PW-519, Eng. News-Record.

STUDY BY MAIL

THE WELL-KNOWN WILSON COURSES

Reinforced Concrete Engineering
Structural Steel Designing
Structural Drafting
Concrete Drafting and Estimating

Arranged by an Engineer with 30 Years' Experience

Many a man has forged his way to the top by using some of his spare time in study. Are YOUR talents fully developed, or only awaiting the magic touch of ambition and application? The WILSON courses were arranged for men who need experience in designing, drafting and estimating. They train you in ACTUAL experience, because you actually do the work. They tell you what IS and what is NOT "good practice" in everyday engineering work.

High School Education Qualifies:

the student for any of the above courses although over 85 per cent. of our students are technical graduates.

Our course in Concrete Drafting and Estimating opens the way to the whole field of engineering, and we recommend it to ambitious non-technical men in the building trades. Don't waste years in "picking up" your experience, when such courses as these can give you what you need in a short time.

Employers are waiting for men trained by us, and we are unable to fill the demand at first-class salaries. *Write today for free literature.*

WILSON ENGINEERING CORP.
HANOVER, MASS.

POSITIONS WANTED

CIVIL engineer; B.C.E. University of Michigan, 1910; 5 years' experience structural steel, reinforced concrete and municipal work; 7 years teaching structural courses: University of Michigan, Johns Hopkins University and Drexel Institute, instructor, assistant professor, associate professor, professor and dean; open for permanent position July first. John H. Bringhurst, Dean, Drexel Institute, Philadelphia, Penna.

CIVIL engineer, technical graduate, age 34; 11 years' experience on highway, railroad, foundation, waterfront and industrial plant construction, surveys, estimates and reports as superintendent and engineer, familiar with designs, specifications, progress records and purchasing materials, sales and business experience; executive and organizer, desires responsible position where tact, energy, pleasing personality and technical knowledge are essential. PW-522, Eng. News-Record, Real Estate Trust Bldg., Philadelphia.

MIXER foreman, civil engineer, wants connection with California or Oregon paving contractor; results guaranteed; now employed; available 2 weeks' notice; salary, $200 and bonus. PW-536, Eng. News-Record, Rialto Bldg., San Francisco.

CIVIL engineer—Construction superintendent or manager, graduate C.E., Assoc. M Am. Soc., age thirty-seven, seventeen years experience heavy construction, excavation, bridges, dams, locks, buildings, paving and roads; available after July first. PW-532, Eng. News-Record.

GRADUATE engineer, certified member A. A. E., age 28, married; five years' experience field and office, reinforced concrete, pavements, sewers, bridges, foundations, design or construction, desires position preferably New York City or within 100 miles; A-No. 1 man; best of references; good health, conscientious, industrious; moderate initial salary; available at once. PW-459, Eng. News-Record.

ESTIMATOR, graduate civil engineer, age 36; 13 years' experience in field and office; A-1 designer and draftsman, capable of taking full charge, desires position with contractor or firm of engineers west of the Rockies. PW-545, Eng. News-Record, Rialto Bldg., San Francisco.

CIVIL engineer, technical education; nine years' experience, construction, office buildings, industrial and power plants; executive ability; can furnish organization for new job. Desires position as superintendent or civil engineer; can be interviewed in New York City; minimum salary, $250.00 per month. PW-550, Eng. News-Record.

CIVIL engineer, technical education, single; 18 years' broad varied experience in designing, constructing, public utilities, municipal development, highways, reinforced concrete, railways computer; location, immaterial. Has complete engineering instruments and best computing machine; actual salary, $200; must change on account of climate. PW-567, Eng. News-Record.

CONSTRUCTION MANAGER

36 years old. Last nine years operating manager large firm of general contractors. Familiar with all classes of work; knows how to handle men; to build an organization of producers; to control and supervise work in process; to buy materials right; and to meet prospective clients. Salary $10,000. Address:

PW538—Engineering News-Record
10th Ave. at 36th St., New York City

CHIEF DRAFTSMAN

or position in responsible charge desired by experienced engineer and designer on industrial plant design, layout of buildings and equipment. Technical training and broad experience in structural steel, reinforced concrete and timber construction, conveying and elevating machinery, power house equipment, etc. Good organizer and executive.

HERBERT DANIEL
344 East 86th St., New York City.

POSITIONS WANTED

CIVIL engineer, technical education; nine years' experience engineer and superintendent of construction, sewers, roads, docks, buildings, municipal work. PW-473, Eng. News-Record.

TEACHING position in engineering school desired by civil engineer. Age 30 and single. Three and half years general engineering experience. Graduate of Normal and engineering schools. PW-561, Eng. News-Record.

THERE is a firm in New York City requiring a young Civil Engineer with two and one half years college training and five years construction experience whom they may put into a permanent position with good future. This young man is ambitious and desires a position in which special training may be required and in which he may grow. Interview may easily be arranged with this young man." Box 114, Briarcliff Manor, N. Y.

CIVIL ENGINEER, graduate, age 29, four years railroad, highway and building construction experience, desires responsible engineering position. Location immaterial. PW-562, Eng. News-Record.

CIVIL engineer, graduate, 15 years' broad office, field and construction experience, with: consulting hydraulic and general municipal engineers, utility companies, engineers and contractors. Details on request. Excellent references. Salary $250 min. ($350 before the war). Any proposition considered. Immediately available. PW-556, Eng. News-Record.

Surveying

INSTRUMENTMAN, conscientious and accurate, several years varied experience, engineering and accurate surveying, wishes position; prefer New England or Ohio, but would consider other locations. PW-482, Eng. News-Record.

TRANSITMAN, three years' experience on building constructon and rairoad work; available immediately; location immaterial. PW-547, Eng. News-Record, Leader-News Bldg., Cleveland.

TRANSITMAN, water control or development preferred; 1920 engineering graduate, 22, wants position with growing firm; any location on definite arrangements. PW-564. Eng. News-Record.

Bridges and Structural

STRUCTURAL engineer, graduate with extensive experience in selling and technical work, especially steel construction, desires position as sales engineer or association with architect; capable of taking charge of work. PW-406, Eng. News-Record.

STRUCTURAL engineer with 20 years' experience estimating, designing, contracting structural steel; six years chief engineer fabricating plant, also experienced in fabrication and erection, seeks position of responsibility. PW-426, Eng. News-Record.

ARCHITECTURAL engineer, 9 years' experience on building construction; structural steel and reinforced concrete design, specification writer and inspector of same, desires position with high-grade firm of architects. Address Roy E. Burkholder, 23 Oppmann Terrace, N. W., Cleveland, Ohio.

STRUCTURAL designer, detailer and estimator, technical graduate, age 28, married; six years' practical experience, desires position in New York City or immediate vicinity. PW-527, Eng. News-Record.

STRUCTURAL draftsman, university graduate; four years of practical experience in structural steel and reinforced concrete wants position in Philadelphia or vicinity. PW-548, Eng. News-Record, Real Estate Trust Bldg., Philadelphia.

BRIDGE and structural designer, checker, technical graduate, 10 years' experience, desires permanent position, New York City. Salary $50.00, available immediately. PW-555, Eng. News-Record.

BRIDGE engineer, 20 years' experience design, construction and maintenance of railroad structures, wishes position as bridge engineer with large railroad; ten years assistant bridge engineer. PW-516, Eng. News-Record.

POSITIONS WANTED

Drafting and Designing

STRUCTURAL concrete draftsman, six years' experience in reinforced concrete design; location New York City. PW-458, Eng. News-Record.

DRAFTSMAN, technical graduate (C.E.), two years' experience, desires position in New York City. Salary $35.00. PW-535, Eng. News-Record.

DRAFTSMAN experienced in railway construction and maintenance work; also the design and calculation of street railway special work. Apply, PW-566, Eng. News-Record, Real Estate Trust Bldg., Philadelphia.

DRAFTSMAN, age 28, wishes position with contractor or engineer—Southern New England preferred. Eight years architectural experience, but would like to change to position with good opportunity. Accurate; and with good references. PW-565 Eng. News-Record.

Superintendents

MECHANICAL superintendent, 18 years' experience in designing, maintenance and construction; good executive and thoroughly familiar with modern efficiency methods. PW-210, Eng. News-Record.

GENERAL superintendent or branch manager; thorough executive and organizer, handling large operations; 16 years' experience with high-class concerns. Desires permanent connection; college education; available short notice. PW-228, Eng. News-Record, Real Estate Trust Bldg., Philadelphia.

POSITIONS WANTED

BUILDING contractor's engineer, experienced superintendent, estimator, designer, technically trained; age 28, married, desires position with a future; will go anywhere. PW-429, Eng. News-Record.

SUPERINTENDENT, 15 years' experience on steam shovel, team work and concrete work, both railway and highway construction, will go any place and will be available about July 15th. Address PW-479, Eng. News-Record, Leader-News Bldg., Cleveland.

SUPERINTENDENT of construction desires position with reliable firm of architects or builders, or resident engineer for a corporation. Special knowledge of reinforced concrete, fire-proofing, important construction work, including government buildings and cost-keeping accounts. Formerly architectural engineer, A1 references; at present employed, age 46 years. Address L. Engelman, 107 South D. Street, Muskogee, Oklahoma.

SUPERINTENDENT, 20 years' experience on heavy construction: tunnels, rock or soft ground; foundations, sewers, bridge, railway and irrigation; difficult excavation, reinforced concrete and underground work a specialty; best references. PW-98, Eng. News-Record.

EXECUTIVE, general superintendent, exceptional experience, management, engineering and construction, chemical and industrial plants; available June 25. PW-507, Eng. News-Record.

CONTRACTORS superintendent; experienced as engineer and contractor in the construction of all classes of roads and pavements, sewers, water works and electrical railroads; C.E. degree and ten years' experience. PW-513, Eng. News-Record.

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We furnish laborers in any number and of all nationalities on short notice. References furnished. Correspondence invited.

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Our system in keeping commissaries holds the men on their job. If you desire to make a success with your contracts, let us handle the commissaries for you.

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CENTRAL EMPLOYMENT &
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Operators of commissary and boarding camp units.

Where we own and operate boarding camps and commissaries, we furnish all classes of laborers free of charge.

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The Erie Employment &
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Room 203-4 Beckman Bldg., Cleveland, Ohio.

Employment Offices at Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; Toledo, Ohio; St. Louis, Mo.; Buffalo, N. Y. We operate Camps and Commissaries. Furnish Laborers, Mechanics and all classes of Skilled Help for Railroads, Industry, etc.

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We own equipment and operate boarding camps for Industrial and Railroad work, and through our Employment Offices furnish help free.

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Labor Agents and Boarding Contractors
We Ship Laborers and Operate
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ALL KINDS OF FORCE ACCOUNT WORK
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OUR RECORD
Ask the Snare & Triest Co. or MacArthur Bros. about our services at Camp Merritt, Port Newark, Camp Raritan, Phila. Quar. Term., Piccadilly Arsenal, etc.

MIELE BROS. TELEPHONE, CANAL 8970
139 MULBERRY ST., NEW YORK CITY

POSITIONS WANTED

INDUSTRIAL engineer, specialist in power plant design and mechanical equipment of buildings, desires charge of work. Capable of superintending construction, estimating, specifying; age 30; married; just released from army; available promptly; salary required, $5,200 minimum yearly. PW-514, Engineering News-Record.

SUPERINTENDENT of construction is available for present or future work on manufacturing, mining and power plants, housing proposition and installation of equipment. Communicate with M. S. Flowers, 920 Massasoit Ave., Chicago, Ill.

WATERWORKS superintendent, married man of 33, experienced in waterworks construction, pumping, filtration and financial management. Have a position at present but would consider a better one. PW-553, Eng. News-Record.

Miscellaneous

CONSTRUCTION engineer, technical graduate, 36, practical experience 7 years, irrigation and hydro-electric power development; now in charge of field work, $2,000,000 reinforced concrete job. Desires responsible outside position with opportunity for advancement. Minimum salary $250. PW-392, Eng. News-Record, Real Estate Trust Bldg., Philadelphia.

IRRIGATION Engineer, graduate, 38, married, 8 years' experience irrigation, 2 years waterpower, 3 years municipal, railroad and highway. Surveys and construction. Employed. Desires permanent position where possible to live at home. Minimum $250. PW-413 Eng. News-Record, Old Colony Bldg., Chicago.

EXECUTIVE, building construction, over 23 years' varied experience. Graduate engineer. Practical engineering 2 years up to resident engineer, then started as foreman; then general foreman, assistant superintendent, superintendent and contractor until world war; now superintendent. Wants to join large organization, (preferably New York City), where the born executive with plenty pep, abundance initiative and innate abilty is appreciated and awarded. PW-496, Eng. News-Record.

DISTRICT manager, engineer, age 44; many years' experience building construction and industrial engineering; open for engagement; high-grade propositions only considered. PW-528, Eng. News-Record.

CONSTRUCTION engineer and executive, technical graduate, experienced on building, railroad and irrigation construction; have successfully handled large development enterprises; at present employed in Atlantic state, power plant construction; prefer location in West. PW-510, Eng. News-Record, Real Estate Trust Bldg., Phila.

TWO men, contractors' engineer and superintendent, associated six years on heavy construction, desire positions together in Eastern states; steam shovel rock and earth excavation, tunnels, foundations, buildings, masonry, concrete, steel, railways and piers; manage all details in field, furnish foreman and leading men; references; available July 15. PW-531, Eng. News-Record.

CONSTRUCTION engineer, with 15 years' experience, accustomed to handling heavy construction work and large bodies of men; open to a new position where ability, initiation and push are most essential. PW-540, Eng. News-Record.

MARINE engineer with technical training, executive ability; 13 years' wide experience in operation, maintenance, construction and repair of marine equipments, desires position with reliable engineering firm or construction company where his experience will be of value and he can prove his ambitions. PW-537, Eng. News-Record.

PHOTOGRAPHER, 15 years' experience, desires position with industrial or construction company; highest references. PW-543, Eng. News-Record, Real Estate Trust Bldg., Philadelphia.

ENGINEER with considerable experience in general industrial work, mining, laying out plants, and development of new ideas, at present in responsible position in New York, desires change. Would go abroad if required. Can speak Spanish. Nationality English. University training. PW-554, Eng. News-Record.

POSITIONS WANTED

FOREMAN with great followers of foreign laborerers and mechanics desires connection with reliable contractor. PW-544, Eng. News-Record.

YOUNG Engineer wishes to locate with a contractor for any department, field or office work, where there is an opportunity. Write, S. B. Frey, 120 W. 93rd St., New York.

EVENING WORK WANTED

A GROUP of men employed by leading firms in the reinforced concrete industry, well acquainted with the best current practice, desires to prepare your construction plans in this field. EW-451, Eng. News-Record.

EXTRA WORK

REINFORCED concrete designing, estimating and detailing done by engineer of twenty years' experience. XW-438, Eng. News-Record.

MECHANICAL and electrical engineer desires additional work on designing and general drafting. Power plants and lighting a specialty. All engineering work done efficiently at reasonable rates. XW-478, Eng. News-Record, Old Colony Bldg., Chicago.

ENGINEER desires extra work detailing or checking structural steel work. XW-557, Eng. News-Record.

VACATION WORK WANTED

WORK for vacation wanted near New York by civil engineering student having two summers' practical experience. VW-432, Eng. News-Record.

WORK WANTED

DRAFTING and surveying by experienced engineers. Architectural, including structural; mechanical; electrical and topographical drafting; computing and plotting surveys; mapping. Surveying, including topographical, boundary, subdivision, laying out buildings, leveling, etc., within fifty miles or more of New York City. WW-401, Eng. News-Record.

Coal, Timber and Hydraulic Developments

Opportunity wanted to figure on large surveys anywhere, coal, timber, and hydraulic developments. Preliminary surveys of all kinds. Twenty years' experience. WW-290, Eng. News-Record.

Grading Wanted for Erie Shovel

Wanted.—Grading for ¾ yard Erie shovel. N. M. Leigh, Fairmont, W. Va.

Work Wanted

At once, for revolving steam shovel with crew, foreman and teams. ALSO, for road building outfit, road roller, paving concrete mixer, and stone unloader and small tools and men. Will work by day or contract.

CHARLES T. EASTBURN
803 Broad St. Bank Bldg., Trenton, N. J.

S. WEISHOFF

Consulting Engineer
1482 Broadway, N. Y. City

THEATRES

Structural steel designs for theatres exclusively, in the most economical form. Considerable money can be saved with the proper steel layout, and various suggestions as to construction. Can refer to theatre structures of my design throughout the United States, now in successful operation.

Interviews can be arranged at short notice

AGENTS AND SALESMEN

Out of Town Connection Wanted

Civil engineer, many years contracting-engineering experience, having New York office, banking and credit accommodations and able to finance good sized propositions is open to handle special matters for out-of-town interests or to represent them permanently. AS-387, Eng. News-Record.

American Structural, Mechanical and Sales Engineer

Will sail for France and England about July 1st. Would like to represent, or undertake commissions for American interests while abroad. Was in France 18 months as Major of Engineers, with First Division, A. E. F.; speaks French, and is acquainted with French railroad officials and familiar with French industries. Cornell graduate with twelve years' experience before the war as structural, mechanical and sales engineer. Especially familiar with reinforced concrete and contractors' equipment; in business on own account 8 years. AS-461, Eng. News-Record, Old Colony Bldg., Chicago.

Engine Manufacturers—Attention

I want to place contracts for the manufacture of stationary gasoline and kerosene engines for which I expect to build up a big market. Paul Able, 811 Oakdale Ave., Chicago.

Engineer Salesman Available

Engineer, age 27, two years' college, five years' experience; at present studying economics of business, desires position as salesman of engineering construction materials. AS-549, Eng. News-Record.

Russian Representative Available

Engineer, Russian, would like to enter Russian field as representative for American manufacturers. AS-486, Eng. News-Record.

BUSINESS OPPORTUNITIES

Completely Equipped Engineering Office

For Sale. Moving to California, will sell my business of consulting engineering immediately. Desirable office with one year's lease, 400 square feet, complete equipment, well indexed catalogues, reference books. Will arrange to sell tracings and records. Apply, to M. Thompson, 189 Montague St., Brooklyn, N. Y.

For Hire: For 4 Months

3—5-ton Garford Trucks equipped with steel dump bodies. Wood Hydraulic Hoist. Good condition. For use in New York, Philadelphia or vicinity.

G. K.—Room 1604
2 Rector St., New York City

Two Machinery Sales Engineers

Wanted to sell general line of Sugar, Cement, Lime, Brick and other Industrial Machinery in Brazil and Mexico. Applicants must have experience, knowledge of requirements and speak Portuguese and Spanish. Willing to be away two years.

Write fully, stating experience, salary, etc.

P500—Engineering News-Record,
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WANTED TO SUBLET

The erection of about 500 tons of

STRUCTURAL STEEL

D. E. Conners
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Attention specially given to matters relating to the rights of Government Contractors before the Executive Departments and the Court of Claims.

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Wheel Scrapers for Sale

Four K. & J. No. 2 wheel scrapers at $50 each. Practically good as new. Richards and Gaston, Contractors, Somerville, N. J.

Transactions A. M. Soc. C. E.

Vol. 35-82, inclusive, except 72, 73, 76 and 77; also Eng. News vol. 51 to 61 and 65 to 73; all well bound, perfect condition. FS-444 Eng. News-Record, Real Estate Trust Bldg., Philadelphia.

Two Four-ton Ladles

In the best of condition, teapot spout type, worm-gear tilting equipment; $150 each f.o.b. our plant. Minneapolis Steel & Machinery Co., Minneapolis, Minn.

Emerson Pump For Sale

New No. 4 Emerson Pump with foot valve and strainer. 6 in. suction, 5 in. discharge. P. W. Burnham & Co., 111 Nassau Street, New York.

Oil Engine For Sale

Fifty horsepower Jacobson Semi-Diesel type, with starter; brand new. Mercer & Miller, 618 American Bank, Richmond, Va.

Trenching Machine For Sale

A 000 Austin trenching machine in A-1 condition. R. F. Relly Contracting Co., Paulsboro, N. J.

FOR SALE

STEEL FRAME BUILDING

85 ft. x 305 ft. 27 ft. high to eaves

Steel in excellent condition.
Immediate Shipment

John Eichleay, Jr., Co.
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20,000 ft. B M.	New	4x4-10-12 ft. long	$37
3,300 ft. B M.	New	4x4-14-16-17 in. long	37
5,000 ft. B M.	New	4x6-12 ft. long	37
10,000 ft. B M.	New	2x4-10-12 ft. long	40
12,000 ft. B M.	New	2x4-14-16-18 in. long	42
20,000 ft. B M.	Used	4x4-6-10 ft. long	27
140,000 ft. B M.	Used	4x4-10-14 ft. long	27
50,000 ft. B M.	Used	4x6-12-14 ft. long	28
20,000 ft. B M.	Used	4x6-16 ft. long	28
10,000 ft. B M.	Used	2x10-8-16 ft. long	29

All new lumber never unloaded.
All used lumber first class condition; no cement; no nails.
All first class yellow pine.
Ready for immediate shipment.
All prices f.o.b. Akron, Ohio.
Write, wire or phone

SERVICE CONSTRUCTION CO.
P. O. Box 915, Pittsburgh, Pa.

PINE PILES

330 Pine Piles for immediate delivery 50% 13-in. x 2-ft. x 6-in. 90% 14-in. x 2-ft. x 6-in. Have cut and ready to be shipped in Delaware. **2,000 piles** 60-ft. long, same specifications as above for sale. Will sell one or all

GULF REFINING COMPANY
Girard Point, Philadelphia, Pa.
Telephone Dickinson 2294

ROCK ASPHALT

We have a quantity of Ground Imported Sicilian Rock Asphalt, in burlap bags. Samples on request

UNION PAVING COMPANY
30th & Locust Sts., Philadelphia, Pa.

TIMBERS

Eight Million Feet of Large Timbers

For Immediate Shipment

From Ashland, Wisconsin

Sizes: 3 x 12, 8 x 12, 10 x 10, 12 x 12, 12 x 16, 16 x 16, 16 x 20.

FIR—PINE—HEMLOCK

Used—Sound—In excellent condition.

150 Tons ⅝-in. Straight Link Coil Chain
300 Tons 35-lb. Relaying Rail
200 Tons Black Pipe ¾-in. to 8-in.

Write or Wire for Prices

CHICAGO HOUSE WRECKING CO.
OF MINN. INC.
80 East Fillmore Avenue, St. Paul, Minn.

FOR SALE

EXPANDED METAL REINFORCING

108,000 sq. ft. Expanded Metal Re-Inforcing 3-249-80 Ten Gauge 4 ft. 3 in. x 4 ft.

175,000 sq. ft. Expanded Metal Re-Inforcing 3-249-80 Ten Gauge 4 ft. 3 in. x 10 ft.

ALSO

100 tons "Stonekote" Stucco.
8500 Machine Bolts, ¾ x 24 in.

Prices very attractive

DU PONT ENGINEERING CO., FLINT, MICHIGAN

FOR SALE

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—AT A BARGAIN

Will keep count and curve drawing sheet record on 20 producing machines. Operates on 20-v. D.C. service.

Original cost $600. First-class shape. Various spare parts included.

W. A. HEFNER
c/o McGraw-Hill Co., 10th Ave. at 36th St., New York City.

KEYSTONE EXCAVATOR

FOR RENT WITH OPERATOR

This is a No. 3 machine equipped for grading or ditching. It is a year old, in good condition and in charge of an efficient and dependable operator. Available about July 1st.

F. D. LEFFINGWELL
Montclair, N. J.

Second-Hand Transits and Levels

Guaranteed in Good Order and Adjustment.
Write for New Bargain List
WILLIAMS, BROWN & EARLE, INC.
918 Chestnut St., Philadelphia, Pa.
Department D

FOR RENT
One Model 3
KEYSTONE GRADER
With crew, available about July 1.
G. W. LAWRENCE CO.
20 Clinton St., Newark, N. J.

OSWALD GRINER
INSTRUMENT MAKER
ARCHITECTS, ENGINEERS
SUPPLIES AND BLUE PRINTING
TRANSITS, LEVELS
BOUGHT, SOLD, RENTED AND REPAIRED
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30 bottom dump
WOODEN BATCH BOXES
27 cu. ft. capacity, like new, used one month.
COLD SPRING CONSTRUCTION CO.
Protection, N. Y.

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Bunks—Upper and lower sleeping Bunks, made of Black Angle Iron, National Spring and helicals, size 2 ft. 6 in., $5.50.

Bunks—Upper and lower sleeping Bunks, made of continuous posts, white enamel, size 3 ft., $6.50.

Steel Lockers, size 12 in. x 15 in. x 42 in. in height (double), in units of 16, $5 per locker.

Pyramid Government Tents—Slightly used, all repaired in first-class condition, made of 12-oz. canvas, 3-ft. wall, size 16-ft. x 16-ft., $30.

U. S. Government Khaki Wagon Covers, New. 10 oz. Size 11 ft. 6 in. x 14 ft. 6 in. Price $16.50.

Pup Tents—Used, in good condition, suitable to cover sewer pipe work, $3.

Tarpaulins—Government used, in fair condition, size 17 ft. x 30 ft., price $40.

U. S. Navy all wool Blankets (white), $6.

U. S. Rubber Hip Boots, new, salvaged from S. S. Port Hunter, all sizes, $4.65.

Cotton Blankets, Double (reclaimed), $1.65.

Contractors' single size Double cotton Blankets, rough, $1.50.

O. D. Government Khaki Comforts (reclaimed), $2.00.

Comforts, fancy scroll designs, $1.75.

Mattress bed sacks, as used by contractors, $0.85.

White cotton felt mattresses, size 3 ft. A. C. A., tick $4.95.

Silk floss mattresses, size 2 ft. 6, A. C. A., tick $5.00.

Cotton Mattress pads, Fancy Tick, size 3 ft. (used), $3.50; in good condition.

Cotton Top and Bottom Mattresses, size 3 ft. (used), $2.50; in good condition.

W. W. REID, INC., 97 Branford Place, Newark, N. J.
Phone Market 950

FOR RENT

Model 43 Marion-Osgood **Steam Shovel.**
Model 40 Marion **Steam Shovel.**
2—18-ton Vulcan **Locomotives,** 36-in. gauge.
2—12-ton Baldwin **Locomotives,** 36-in. gauge.
30—Western two-way four-yard **Dump Cars,** 36-in. gauge.

FOR RENT OR SALE

1—40-hp. **Portable Engine and Boiler.**
1—No. 2 Climax Portable **Crushing Plant.**
2—15-30-hp. **Titan Tractors.**

F. B. BEASMAN
1415 Fidelity Bldg.
Baltimore, Md.

FOR RENT

Thew Steam Shovel

¾-yd. dipper. In good condition, with first-class engineer and fireman. Ready to go on job June 15th.

SUTTON & CORSON CO.
Ocean City, N. J.

MACHINERY — **WANTED** — **MISCELLANEOUS**

WANTED

Full Circle
STEAM CRANE

of the Locomotive type suitable for mounting on a barge and capable of handling a 1½ to 2½ yard bucket in coal. Would consider machine with or without traveling mechanism and with or without boiler.

W563—Eng. News-Record
10th Ave. at 36th St., New York City

WANTED
GEAR CUTTER

Automatic modern type, for spur gears, 90 to 100 inches diameter. Must be in A-1 condition for accurate work. State age, location, price and complete description.

BELOIT IRON WORKS, Beloit, Wis.

WANTED
Switching Locomotive

About 50-ton

The Morrison & Risman Co.,
Buffalo, N. Y.

WANTED

1 Gasoline Driven
PORTABLE AIR COMPRESSOR

Capacity 100 cu. ft. or over.

ROBERT G. LASSITER & CO.
Norfolk, Va., Raleigh, N. C.

WANTED
One
RAILROAD DITCHER

American preferred. Advise condition, location for inspection and price.

PITTSBURGH CONSTRUCTION CO.
Pittsburgh, Pa.

WANTED
DUMP CARS

15 to 20—36-in. gage, 2-yd. Koppel V-shape, two way side dump cars.

Must be first-class.

W420—Engineering News-Record
1570 Old Colony Bldg., Chicago, Ill.

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"Think SEARCHLIGHT *First"*

0109

WANTED
Two Transformers

60-cycle, 50 kva. each (or will accept 37½ or 75 kva.) 2200 volts to 440 volts.

With taps to give Scott connection for transforming from 2-phase high tension to 3-phase low tension.

Will consider proposal for 3 transformers if each one has taps for both 50% and 86.6% so that any transformer can be used in either position of the Scott connection. State price, location, make, type and serial numbers.

CHARLES WARNER CO.
Wilmington, Del.

WANTED

A large industry wishes to purchase 60 to 70 ton
SWITCHER
with separate tender.

W542—Engineering News-Record
10th Ave. at 36th St., New York City

WANTED
STEEL SMOKE STACK

About 60-ft. long, 28-in. diameter, 10 gauge steel. Give full particulars and lowest price.

EDWARD W. DE KNIGHT
120 Liberty Street, New York.

MACHINERY **WANTED** MISCELLANEOUS

Mr. Contractor—Mr. Manufacturer

Sell Us Your Scrap Iron

to our yards at

Philadelphia and Lebanon, Pa.

At our two modern equipped, up-to-the-minute yards we handle mixed carloads of SCRAP IRON at minimum cost. We can, therefore, make exceptionally *good prices* to Contractors and Manufacturers on all kinds of scrap.

We dismantle *anything—anywhere* and ship direct to mill. Get in touch with us, no matter what you have—and get best results.

We dismantle anything—anywhere

STERLING IRON & STEEL CO.

PHILADELPHIA, PA.
10th and Hamilton Sts.
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—PHONES—

LEBANON, PA.
Lehman and 16th Sts.
Lebanon 84

WANTED

2 Clam Shell Buckets

anywhere from ½- to ¾-yard, also 10-in. Morris

Centrifugal Pump

Price and particulars to

WM. GRACE CO.
Tacoma Building, Chicago

WE WANT TO BUY

One MODEL 76 MARION STEAM SHOVEL, with standard equipment.
Two 15 to 20 TON EIGHT WHEEL LOCOMOTIVE CRANES.
One CATERPILLAR TRUCK STEAM SHOVEL, 1¼ Yard Dipper, Etc.
One STEAM SHOVEL on TRACTION WHEELS, ¾ Yard Dipper.

Please advise make, shop numbers, age, actual condition, location, and LOWEST CASH PRICE to us.

A. C. TORBERT
Continental & Commercial Bank Building, Chicago

WANTED TO BUY

Hoisting Engines
Concrete Mixers
Cranes—Draglines
or any
Construction Equipment

EQUIPMENT CORP. OF AMERICA
Lumber Exchange Bldg., Chicago, Illinois

Wanted to Buy Immediately

CATERPILLAR TREAD or WALKER DRAGLINE

1, 1½ and 2 yd.; must be in good working condition. State price and where can be inspected.

W. H. HANNA
53 Broad St., Charleston, S. C.

WANTED

Steel Piling

635 pieces—19 to 25 ft. lengths
220 pieces—30 to 33 ft. lengths
458 pieces—46 to 50 ft. lengths

24 corners for the above

Advise number of pieces, make, length, condition, price f.o.b. cars, when shipment can be made and where to apply for immediate inspection.

W531—Engineering News-Record,
1570 Old Colony Bldg., Chicago, Ill.

If You Want to Buy or Rent Repaired Equipment

CARS

(STANDARD GAUGE)

90—20-yd. capacity standard gauge Magon air dump cars. These are new cars, built for U. S. Government, steel construction throughout, with wood floors.

67—12-yd. capacity standard gauge Western Wheeled Scraper Company's Cars. These are new cars, built for U. S. Government; latest type construction.

30—12-yd. Western Standard Gauge Air Dump Cars, 26-ft. beds.

BUCKETS

12—1-yd. to 36-ft. Steubner controllable, center dump.

8—30-ft. Insley controllable.

5—27½-ft. Lakewood Eclipse.

LOCOMOTIVES

8—18-ton 10 x 16-in. H. K. Porter dinkeys, 36-in. gauge.
1—14 x 20 Saddle tank; standard.
2—American 10 x 16-in. Dinkey Locomotives, 36-in. gauge, with butt-strapped boilers.
1—20-ton, 10 x 16-in., standard gauge Baldwin.

MISCELLANEOUS

Air Compressor, Ingersoll-Rand, Class NE-1, belt driven, 310 cu.ft. capacity.

2—Vulcan Drop Hammers.

Cableway, 1164 ft. span, complete with Lidgerwood 9 x 10 cableway engine, 3-ton cap.

Boiler, portable locomotive type, 100-hp. butt strapped.

1—12 x 17 x 10 x 15 Worthington Steam Pump, for 140 lb. water pressure.

1—10-ton, 3-wheel Kelly-Springfield Roller.

1—1-Bag Koehring Paver, new gasoline engine on traction wheels, with 8-ft. chute.

PUMPS

We have a large stock of contractors' pumps, both steam and gasoline operated.

STEAM SHOVELS

2—Marion 60 shovels, Shop Nos. 1999 and 2059.
1—Model O Thew Full Revolving, on Traction wheels, shop No. 1084.
1—Standard type "B" Erie, ¾-yd. dipper.

HOISTING ENGINES

Lidgerwood 9 x 10, 2-drum cable-way engine.
Mundy 6¼ x 10-in. 2-drum engines.
Byers, 6 x 8 2-drum engines.

H. KLEINHANS CO., Union Arcade, Pittsburgh, Pa.

Eastern Office: 30 Church Street, New York

Get It From KLEINHANS

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BOUGHT ECA REBUILT RENTED
SOLD

WE BUY—
REBUILD—
SELL—
OR RENT—

All the Equipment listed below is owned by us and may be inspected at one of our own warehouses.

AIR COMPRESSORS

4—Chicago Pneumatic Tool Co., Class N-SGLTM 10½-in. x 7¼-in. x 10-in. with gas engine and air receiver mounted on trucks. Several Steam and Belt Driven Compressors.

BOILERS

21—Upright Boilers ranging in size from 6-hp. to 50-hp.
5—Locomotive type Boilers from 30-hp. to 100-hp.

BUCKETS

16—Clam Shell buckets ranging from ⅓ cu. yd. to 2 cu. yd., some with teeth, following makes: Hayward, Williams, Owens, O. & S., Haiss and Obenberger.
2—Hayward Orange Peel, one ¾-yd., one 1-yd.
1—2½-yd. Butler Dragline. New.
1—1-yd. Dragline.
5—Contractors' buckets, various types, bottom dump, tipover, self-dumping and self-righting, ½-yd., ¾-yd. and 1-yd.

CONCRETE MIXERS

1—One yard McKelvy mixer with batch hopper, on skids, no power.
1—1-yd. on skids, with batch hopper, with steam engine, no boiler, Lakewood.
1—1-yd. Smith Tilter on skids with charging spout; steam engine, no boiler.
All following mixers are on trucks.
10—¾-yd. M-C, steam engine, boiler, water tank, 5 with side loader, 5 with batch hopper.
7—¾-yd. with steam engine, boiler, water tank, either batch hopper or side loader. Following makes: Koehring, Ransome, Cube and Smith-Chicago.
12—½-yd. M-C steam engine, boiler, water, tank, 6 with side loader, 6 with batch hopper.
12—½-yd. with steam engine, boiler, side loader, water tank. following makes: Koehring, Milwaukee, Cube, Smith, Ransome Smith-Chicago and Foote.
4—½-yd. with gasoline engine, side loader, water tanks, 3 Municipal Cube and one Marsh-Capron.
5—½-yd. with batch hopper, with water tank, 1 with electric motor, 1 steam engine and boiler, 1 steam engine, no boiler, 2 without power. Following makes: M-C, Oshkosh and Ransome.
6—1/3-yd. with steam and gasoline power, with side loaders, water tanks. Following makes: M-C, Chain Belt, Milwaukee, Smith and Ideal.
8—¼-yd. with Steam or Gasoline Power with side loaders, water tanks. Following makes: Marsh-Capron, Milwaukee, Cube, and Ransome.
10—One bag low chargers, with gasoline engine. Following makes: M-C, Ransome and Standard.
6—4 cu. ft. Little Devils.
4—Mortar Mixers, C. H. & E. and F. & A.

CARS

Large quantity, 24 gauge, V shaped cars, capacity ⅓-yd. to 1½-yd.
Large quantity, 36 gauge and standard gauge, Western Dump Cars, size 4-yd. to 12-yd.
24—1½-yd. 24-in. gauge Koppel, V shape, with spring draft gears, practically brand new, used one month.
12—Same as above, equipped with brakes.

PUMPS

1—Morris Centrifugal pump, 12-in. suction, 10-in. discharge, direct connected steam engine.
1—Morris Centrifugal pump, 6-in. suction, 5-in. discharge, direct connected steam engine.
1—Fairbanks-Morse, Centrifugal, 5-in. suction, belt driven.
1—Morris Centrifugal sand pump, 6-in. suction, direct connected steam engine.

DERRICKS

1—All Steel Stiff Leg, mast 36-ft., boom 60-ft.
1—Stiff Leg, boom 16-in. x 16-in. x 80-ft., mast 16-in. x 16-in. x 50-ft., bucket operating, like new.
2—Stiff Leg Derricks, boom 14-in. x 14-in. x 60-ft., mast 12-in. x 12-in. x 32-ft., sills and legs in proportion. Terry & Tench fittings, 2 arranged for clam shell, 1 for single line.

HOISTS

1—10 x 12 D.C., 3-drum Lidgerwood hoisting Engine complete with boiler and banked levers.
1—10 x 12 D.C., D.D. Lidgerwood, with banked levers, no boiler.
2—9½ x 12 D.C. 3 drum with boiler, one Lambert and one National with attached swinger.
1—8½ x 10 D.C., 3 drum Lambert skeleton hoisting engine.
1—9½ x 10 D.C., single drum tower hoist without boiler.
5—8¼ x 10 D.C., D.D., with boiler, Lamberts, Lidgerwoods, Flory, Clyde or Mundy.
1—7½ x 12 D.C., D.D. Mundy with attached swinger with boiler.
4—7½ x 10 D.C., D.D. Lambert, with boiler.
1—7½ x 10 D.C., three drum with attached swinging gear with boiler, Mundy.
15—7 x 10 D.C., D.D. with boiler, American, Lidgerwood, Lambert, O. & S., Mundy, Clyde and Flory.
4—7 x 10 D.C., D.D. without boiler, Mundy, National and Flory.
1—6¼ x 10 D.C., D.D. Flory, with boiler.
1—6 x 8 D.C., D.D. O. & S., without boiler.
3—5 x 7 D.C., D.D. Byers, with boiler.
1—30-hp. Electric Hoist, A.C., 220-volt, 60-cycle, 3-phase, double drum American with attached swinger.

HOISTS (Continued)

4—Swinging Engines, Mundy, Dake or Mead-Morrison.
2—4¾ x 6 single drum American with elevator sheave reversible.

CRANES

1—Type "C" Byers Crane, with 30-ft. boom, ⅝-yd. clam shell bucket.
1—12½-ton four wheel Browning Locomotive Crane, equipped with 40-ft. steel lattice type boom, bucket operating.

STEAM SHOVELS

1—Type O Thew with ⅝-yd. dipper, fully revolving, traction wheels.

EXCAVATORS AND BACKFILLERS

3—Keystone Excavators, steam engine boilers, complete with skimmer scoops.
1—Buckeye Wheel Type Trenching Machine, No. 1, with gasoline engine, on caterpillar traction.
2—Waterloo Backfillers, with gasoline engine.

LOCOMOTIVES

1—Porter 10 x 16, 4-wheel saddle tank, steam, 36-in. gauge, 18-ton.
1—Vulcan 9 x 14, 4-wheel, saddle tank, steam, 36-in. gauge.
2—Davenport, 7½-ton, 24-in. gauge, steam, 4-wheel.
1—Porter 6 x 10, 4-wheel, 36-in. gauge, 5-ton.
2—Plymouth, 6-ton gasoline, 24-in. gauge.

PAVING MIXERS

1—Koehring No. 14 with steam engine and boiler and boom and bucket.
1—Chain belt, steam, with boom and bucket, capacity 21 cu. ft. loose.
1—Smith-Chicago with Novo gas engine with distributing chute, capacity 15 cu. ft. loose.

RAIL AND TRACK

2000 Lineal ft. 24-in. gauge portable track, 20-lb. rail, steel ties.

ROAD ROLLERS

1—15-ton Port Huron, 3-wheel, steam.
1—10-ton Port Huron, 3-wheel, steam.

WHEELBARROWS AND CONCRETE CARTS

300—Wheelbarrows, good condition.
100—Concrete Carts, good condition.

We have a large stock of miscellaneous equipment and also heavy equipment not listed in this AD. Write or wire your requirements

Equipment Corporation of America

Philadelphia
Land Title Bldg.

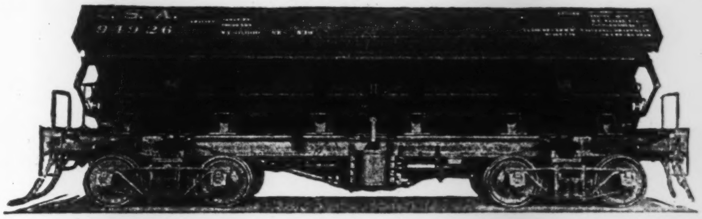
CHICAGO, ILL.
Lumber Exchange Bldg.

Pittsburgh
Empire Bldg.

NEW DUMP CARS

Built for U. S. Government—Ready for Shipment on Own Wheels

90—20-YARD CAPACITY MAGOR CARS



These are Latest Type All Steel Car, with 4-in. Timber Floors, to Latest Specifications

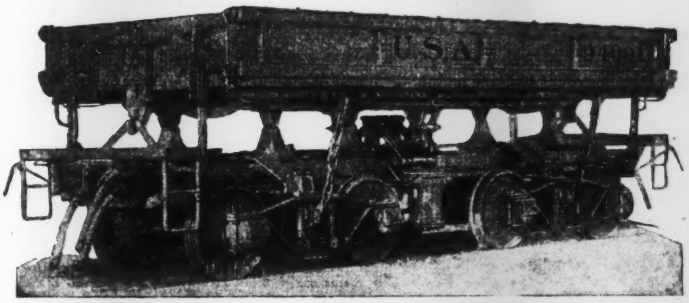
GENERAL DESCRIPTION—MAGOR CARS

Gauge—4 ft. 8½ in.
Capacity—20 cu. yds. level full.
Length over end sills—31 ft. 0 in.
Width over all, not to exceed—10 ft. 0 in.
Height over all, approx.—8 ft. 4 in.
Center to center of trucks—20 ft. 0 in.
Length inside of body—28 ft. 0 in.
Width inside of body, approx.—8 ft. 5 in.
Depth inside of body—2 ft. 3½ in.
All Steel Underframe.

Trucks—Standard, 5 x 9 in., rigid arch bar type, MCB, 80,000 lb. capacity.
Floor—4-in. timbers, shiplapped.
Doors and Ends—All Steel Construction.
Couplers—M.C.B. Automatic.
Dumping Device—2-20 in. Vertical Cylinders.
Locking Device—Automatic Compression.
Safety Appliance—U. S. Standard.

67—12-YARD CAPACITY WESTERN CARS

Built by the Western Wheeled Scraper Company, for the U. S. Government, to latest specifications
Available for immediate shipment on own wheels



GENERAL DESCRIPTION—12-YARD WESTERN CARS

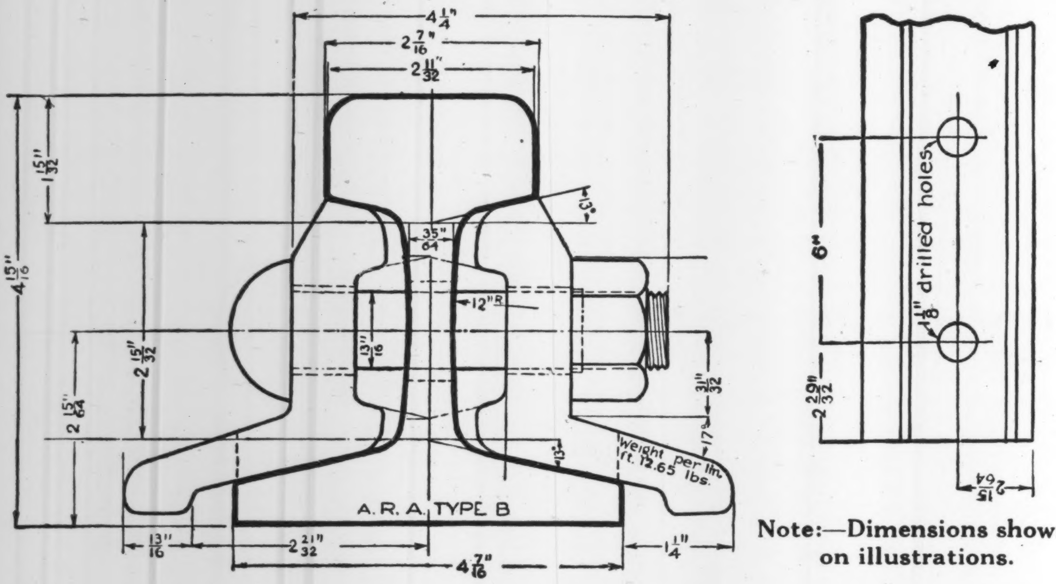
Gauge—4 ft. 8½ in.
Capacity, level full—12 cu. yds.
Length of body, inside—19 ft.
Width of body, inside—9 ft.
Height of body, inside—1 ft. 10½ in.
Height of body, above rails—7 ft. 8 in.
Truck Capacity—60,000 lb.
Journals—M.C.B., 4¼ x 8 in.

Safety Appliances—U. S. Standard.
Special Equipment—2 Vertical Dumping Cylinders and two train lines for operation of dumping mechanism.
Locking Device — Western Wheeled Scraper Company's "Chain" type.
Draft Gear—"Western" single spring type.
Floors, Sides and Ends of Body—Wood.

H. Kleinhans Company, Union Arcade, Pittsburgh, Pa.

NEW RAIL & ACCESSORIES

We own and offer for prompt shipment 80 lb. A.R.A. Type "B" Rail approximately 75,000 gross tons—drilled—standard lengths.


4 1/4"
2 7/16"
2 11/32"
1 15/32"
4 15/16"
2 15/32"
2 15/64
13°
35/64"
12"R
13/16"
3 1/32"
17°
13°
Weight per lin. ft. 12.65 lbs.
A. R. A. TYPE B
13/16"
2 21/32"
4 7/16"
1 1/4"
1 1/8" drilled holes
6"
2 29/32"
2 15/64

Note:—Dimensions shown on illustrations.

Accessories for 80 lb. Rail

Angle Bars, Track Bolts and Nuts—Size 7/8 in. x 4 1/4 in.
Track Spikes—Size 9/16 in. x 5 1/2 in.

This material is in storage in varying amounts at the following points:
NORFOLK, VA. KEARNEY, N. J.

Also a tonnage of new open hearth 90 lb. rails and accessories, A.R.A. section type "A" located at our yards, East Chicago, Ind.

Owing to the scarcity of rails, prompt action is necessary.

Quotations and further particulars on request.

HYMAN-MICHAELS COMPANY

(Refer to Department "A")

People's Gas Building, Chicago, Ill.

Branches: New York—Pittsburgh—St. Louis

DU PONT

WAR SURPLUS EQUIPMENT

How a turbo-generator paid for itself

Manufacturer buys $13,000 power-machine from Du Pont surplus for $7,500 and saves $7,488 on current besides

A Boston manufacturer who bought a turbo-generator from among our surplus equipment for almost half price, also saved two months power expense by getting immediate delivery.

Before calling upon us, this manufacturer had tried to buy a new generator. He was willing to pay the $13,000 asked for it, but could not wait two months for delivery. Then he came to our plant at Carney's Point and found just the generator he needed for only $7,500. The money he saved on two months power cost, which was $7,488, almost paid for the generator.

While at Carney's Point, this manufacturer also bought other machinery he needed at decided bargain prices. He told us later that he had saved his firm $21,000 on the equipment he purchased.

You, too, can take advantage of this unparalleled sale, and buy the equipment and material you need for your business, at a great saving.

There are more Turbo-Generators for immediate delivery

Condensing and non-condensing turbo-generators. Direct and alternating current. From 300 K. V. A. to 1000 K. V. A.

Buyer can inspect now at our plants, Parlin, N. J., Haskell, N. J., and Hopewell, Va.

An inspection of what we offer in used equipment and material will convince you of its value. Everything is guaranteed to be in serviceable condition.

Don't delay a single day. You must act quickly to get your share of the bargains. Our supply is fast diminishing.

All offerings subject to prior sale.

Write, phone or wire, telling us what you need, or come personally to any of our plants below and see what we have to offer.

Unprecedented opportunity to get good equipment with the high price worn off

- **Turbo Generators** ☐
- **Air Compressors** ☐
- **Blowers** ☐
- **Boiler Tubes** ☐
- **Cafeteria Equipment** ☐
- **Condensers** ☐
- **Converters** ☐
- **Corliss Engines** ☐
- **Engines with Generators** ☐
- **F. W. Heaters** ☐
- **Generator Sets** ☐
- **Gauges** ☐
- **Gasoline and Electric Locomotives** ☐
- **Lubricators** ☐
- **Duplex Pumps** ☐
- **Compound Pumps** ☐
- **Hydraulic Pumps** ☐
- **Centrifugal Pumps** ☐
- **Rotary Pumps** ☐
- **Vacuum Pumps** ☐
- **Triplex Pumps** ☐
- **Diaphragm Pumps** ☐
- **Stacks** ☐
- **Stokers** ☐
- **Tanks** ☐
- **Transformers** ☐
- **Valves** ☐

CHECK THIS COUPON

Enclose with your name and address
and mail to Sales Dept.

Du Pont Chemical Company
Incorporated
Wilmington, Delaware

(35)

Du Pont Chemical Company

Incorporated

Wilmington, Delaware

Barksdale, Wis.
Carney's Point, N. J.
Hopewell, Va.
Haskell, N. J.
Parlin, N. J.

Liquidation Sale

Foundation Company Shipyard No. 5
Savannah, Georgia

The Foundation Company is offering for sale in one lot, or in parcels to suit purchasers, all Plant, Ship Equipment and Materials, comprising—

- *Acetylene Manufacturing Outfit*
- *Air Compressors and Receivers*
- *Boilers*
- *Flat Cars*
- *Wall Cranes*
- *Traveling Cranes*
- *Locomotive Cranes*
- *Derricks*
- *Drill Presses*
- *Drilling and Counter Sinking Machines*
- *Hoisting Engines*
- *Electric Welding Machines*
- *Furnaces*
- *Generators*
- *Motors from 3 to 200 H. P.*
- *Planers*
- *Punches*
- *Lathes*
- *Power Saws for steel or wood*
- *Transformers*
- *Auto Trucks and Tractors*

Pipe Cutting, Threading and Bending Machines Office Equipment of all kinds

Ship Equipment complete for five ships, including:

- *Scotch Marine Boilers*
- *Marine Engines*
- *Marine Electric Generator Sets*
- *Marine Pumps*

General supplies of all descriptions, including Manilla Rope, Wire Cable, Bolts, Pipe and Fittings, Valves, Canvas, Yale & Towne ½ to 5-ton Hoists, Steel Lockers, Hair Felt, Oakum, Caulking Cotton, Sheet Lead, Lead Pipe, Granulated and Slab Cork.

Yard Tools, comprising Pneumatic Riveting Hammers and Compressed Air Tools of all kinds. Electrically operated tools, track jacks, hydraulic jacks, etc.

Address all communications to or call at our Savannah Office, Shipyard. Postoffice Box 1238. Telephones 5900-5901-5902-5903-5904. Long distance call 9919.

Yard will be open for inspection between the hours of 9 a. m. and 4 p. m. daily, except Sunday.

The Foundation Company

GENERAL CONTRACTORS

New York
Seattle
Chicago
Paris, France
Atlanta
Pittsburgh
Lima, Peru
New Orleans
San Francisco
Montreal

Dredges—Sand and Gravel Machinery

Now ready for delivery

12-in. Morris extra heavy dredging pump arranged for electric drive.

3-drum Flory hoist directly connected to 10 hp. motor, complete with control.

1½-in., three stage Morris centrifugal priming and general service pump directly connected to 5 hp. motor.

These three pieces comprise the essential equipment for a 12-in. electrically driven suction dredge. This equipment is of the latest design and of very rugged construction. The pieces have never left the manufacturer's shop and are now on the floor ready for immediate shipment. This is the only opportunity to get new equipment of this sort in less than five months' delivery. Plans for hull and machinery arrangement can also be furnished.

USED EQUIPMENT

5½-yd. **Marion Dipper Dredge** fully equipped, in excellent condition, hull 105 ft. x 40 ft. x 9 ft.

1—10-in. patented Morris manganese lined belt driven **Dredging Pump** suitable for pumping coal, sand, gravel or tailings.

1—12-in. extra heavy belt driven **Morris Sand Pump.**

1—**Standard Cutter Ladder** for 12-in. dredge complete with engine, gears, trunnions and A frame fittings.

1—**Symons Disc Crusher,** No. 30.

1—8½ x 12-in. single drum **Mundy Hoist with Boiler.**

1—Single drum **Flory Electric Hoist** with 42-in. x 38-in. drum.

2—2-yd. Steubner bottom dump **Buckets.**

1—8-in. **Suction Dredge,** complete, hull, 50-ft. x 21-ft. x 38-in. with 8-in. Morris dredging pump driven by Fairbanks-Morse oil engine.

PIERCE J. McAULIFFE, 17 Battery Place, New York City

Electric Steel Gantry Crane

170 ft. span, 55 ft. lift
Capacity—10,000 lb.—80 ft. from centre
Capacity—30,000 lb.—40 ft. from centre
Racked by gears. Complete with motors, etc.

Mounted on runway 18 ft. wide, 580 ft. long, 29 ft. and 20 ft. bays, including foundations. 30 supporting piers, properly braced in both longitudinal and cross sections, equipped with 4 lines of 80 lb. rails. Cantilever supported on 4 Cast Steel Trucks. Each truck has 4 flanged steel wheels locked in place with 15-in. Channel on top of wheels.

Structural material in trestle, rails and racks.. = 427 tons
Cantilever (structural material)............ = 60 tons
Trolley, motors, gearing and trucks........... = 25 tons
512 tons

Motor 240-volt D.C.

All Enclosed	Travel	50 hp.—D7112	Series Wound
	Traverse	B8757	
	Hook	25 hp.—	

The American Ship Building Company
Dept. D. **Cleveland, O.**

FOR SALE OR RENT
Shovels, Locomotives, Graders, Mixers, Cars, Hoists, Rails, Portable Track, Derricks, Clam Shell Buckets, Etc.
F. E. B. O'BRIEN
41 So. 15th St., Philadelphia, Pa.
Phone Spruce 2262

FOR SALE OR RENT
No. 3 Keystone Excavator
available after June 26th.
GEO. W. HARROP
136 Passaic Ave., Garfield, N. J.

LIGHTING PLANT FOR SALE

1—100-hp. Fairbanks-Morse Oil Engine, 2 cy., 4-cycle, directly connected with alternator (Fairbanks-Morse Electrical Mfg. Co.) KVA 75, Type D-450, 2300-volt, 3-phase, speed 257, 60-cycle, amperes per phase 18.8, No. 25,653.
1—50-hp. same make as above, directly connected alternator, KVA, 37½ A, Type D, 2300-volts, 3-phase, amperes per phase, 9.4, speed 300, 60-cycle, No. 34,415 Frame Size D-400A.
2—Direct Current Dynamos, same make as above, KW 5, 115-volt, ampere 43.5 type FR adjustable for 1900 R.P.M. no load 110-volt, loader 115-v.
1—Complete switchboard connected.
1—Air compressor and 2 air tanks.
1—2½-hp. Gas Engine.
1—Circulating Pump.
1—Large Oil Tank ½-in. steel 1 car load capacity.

Wire for option for inspection

The VICTOR L. PHILLIPS Co.
7th and Delaware Streets
Kansas City, Mo.

FOR SALE

LACKAWANNA STEEL PILING

360 tons 14 in. x ⅜ in. arch web section in 25 to 30 ft. lengths. Located in Philadelphia. Will sell whole amount or selected lots.

T. L. EYRE
1537 Commercial Trust Bldg.
Philadelphia, Pa.

Desirable New and Used POWER PLANT Machinery

at attractive prices

IMMEDIATE DELIVERY

Send for latest copy of

"T. P. Economist"

listing 500 items including

Fans, Pumps, Motors, Evaporators, Tanks, Engines, Air Compressors, Cranes, Autoclaves, Ice Machines, Mixers, Generator Sets.

WATER TUBE BOILERS

CG237. 14—264-hp. B. & W. boilers. Drums double riveted, lap joint, 150 lb. pressure.

CG284-A. 2—302-hp. B. & W. boilers for 160 lb. 3,021 sq.ft. heating surface each, in two batteries, 16 sections of 9 4-in. x 18-ft. tubes. Perfection grates, 68 sq.ft. Full front. Murphy stokers, feed pumps and heater. Space per two boilers, 24-ft. 2-in. x 20-ft. 2-in. deep, 16-ft. 8½-in. floor to steam outlet flange. Hartford inspected. Pa.

TP1663-A. 350-hp. Erie City vertical water tube boiler, 125 lb., Butt strap, double riveted. Heating surface 3,741 sq.ft. Grates 8 x 7 ft.

CG338-A. 3—400 hp. B. & W. boilers. Heatinf surface 4,000 sq.ft. Drums double riveted, lap joint. American underfeed stokers. Pressure 160 lb.

CG272-A. 2—400-hp. Wickes water tube boilers, A. S. M. E. code, 150 lb. pressure.

CG294. 500-hp. Sterling boiler, class F, No. 30 drums lap riveted, 150 lb.

CG410-A. 4—600-hp. Babcock & Wilcox boilers. New, never set up. 200 lb. steam pressure. Built according to A. S. M. E. Boiler Code. Each boiler has 6,001 sq.ft. heating surface, Dietrich arches, Detroit stokers. Md.

HEATERS

TP-1651-E. 500-hp. Moffat open type feed water heater.

HG-1393. 775-hp. F. L. Patterson closed straight flow feed water heater, 300 sq.ft. Va.

HG-1392. 9—5,100-hp. Alberger Pump & Cond. Co. closed Wainwright Even Flow feed water heaters, 1,500 sq.ft. Va.

HG-1351. A 7,500-hp. Warren-Webster open feed, water heater, equipped with Lea V notch recording meter, 160 sq.ft. 400,000 lb. water per hour. Va.

LOCOMOTIVES

TP-1640-J. 2 Electric locomotives, 36-in. gauge, capacity 8 to 10 tons, weight 3,600 lb. each, 4-ft. wide, 5-ft. long. With necessary battery.

TP-1640-K. 3 Industrial tractors, capacity 5 to 7 tons. 36-in. gauge, weight 2,400 lb. With 30 A4 Edison cells each. Width 37-in.; length 48-in. over all.

ON-1745-A. 2—5-ton storage battery locomotives, 36-in. gauge, with 40 cells MV 13 iron clad oxide storage battery. Capacity 189 amps., 80 volts, draw bar pull 800 lb., 5.2 miles per hour.

NR-2009. 20—36-in. gauge electric locomotives, height of platform 2-ft. 3-in.; wheels 16-in. x 3-in.; length over all 12-ft. 3-in. Battery 40 cells W.M.L., 13 Phila., 2 10-hp. motor with double reduction gear

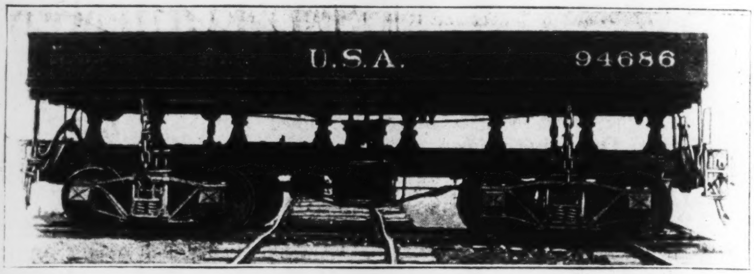
TECHNICAL PRODUCTS CO., Inc.
501 Fifth Ave., New York

FOR SALE OR RENT

New Western Air Dump Cars

Standard Gauge U. S. Safety Appliances

These cars comprise the entire lot of U. S. Government cars of this size and type ordered during the War and not completed until March, 1919



16-yd. Composite Type Cars

All Steel construction except wooden bed. Built by Western Wheeled Scraper Co., to following specifications:

Gauge of track: 4 ft. 8½ in.
Length of body, inside: 26 ft.
Width of body, inside: 9 ft.
Height of body, inside: 2 ft.
Height of body above rails: 7 ft. 11 in.
Center to center of trucks: 18 ft.
Truck capacity: 60,000 pounds.
Journals: M.C.B. 4¼ in. by 8 in.
Catalogue reference: Western Wheeled Scraper Company's Code—"Atwist."

Located, Norfolk, Va.

20-yd. All-Steel Cars

Built by Western Wheeled Scraper Co., Aurora, Ill., to following specifications:

Gauge of track: 4 ft. 8½ in.
Length of body, inside: 26 ft.
Width of body, inside: 9 ft.
Height of body, inside: 2 ft. 4 in.
Height of body above rails: 8 ft. 3 in.
Center to center of trucks: 16 ft. 8 in.
Truck capacity: 80,000 lbs.
Journals: M.C.B. 5 in. by 9 in.
Draft gear: "Farlow" type with Class "G" springs.

Located, Chicago, Ill., Jeffersonville, Ind.

IMMEDIATE DELIVERY

Cars priced at big saving over present factory prices

Clapp, Norstrom & Riley, 14 S. Canal St., Chicago

FOR SALE

Two type B

ERIE SHOVELS

$5,000 and $6,000, first-class condition, immediate delivery.

CABLE CO.
Canton, Ohio

FOR SALE

Steam Shovel

Marion Model 31, 1-yd. Dipper, Caterpillar Traction. New, ready for shipment July 10th from factory.

Also used Whitcomb Gasoline

Locomotive

and Sturtevant

Ring Roll Mill

R. B. DIXON
Gurnee, Ill.

FOR SALE OR RENT

Owned by Us and Sold Under Absolute Guarantee

REVOLVING TRACTION SHOVELS

1—14-B Bucyrus traction wheels, No. 1663, ¾-yd. dipper.
1—Model 31 Marion on Caterpillar, 1-yd. dipper, Shop No. 3850, good condition, immediate shipment.

DUMP CARS

50—12-yd. standard ga. Western Air Dump Cars.
148—New 20-yd. capacity all steel standard gauge Western Air Dump Cars. Latest type.
100—New 16-yd. capacity standard gauge Western Air Dump Cars; composite type, wood beds and all steel underframes.
15—16-yd. standard ga. Western Side Dump Cars.
22—4-yd. 36-in. gauge Continental Side Dump Cars.
40—4-yd. heavy duty Western 36-in. gauge Side Dump Cars.
2—Western 36-in. gauge Spreader Cars.
20—1½-yd., 24-in. gauge Western Dump Cars

ROAD BUILDING EQUIPMENT

6—1½-yd. Western bottom Dump Wagons.

BOILERS, MIXERS, DERRICKS, COMPRESSORS, ETC.

2—Milwaukee (16 cu.ft.) Mixers.

3—1-yd. Concrete Buckets.

6—24-in. gauge 1-yd. Koppel Cars.

1—Brownell, 72-in. x 18-ft., horizontal Tubular Boiler, with 4-in. tubes.

1—20 x 22¼ x 15¼ x 21 AA-2 Ingersoll-Rand Compressor; 1600-ft. capacity.

1—30 x 6 Vertical Air Receiver, complete.

1—16 x 16 x 18-in. Laidlaw-Dunn-Gordon Air Comp., with reservoir; weight 15,000 lb.

STEAM SHOVELS

4—70-C Bucyrus, Shop Nos. 1160, 1268, 1331, 1712, 2½-yd. dippers.
1—65-ton Bucyrus, Shop No. 394, 2½-yd. dipper.

LOCOMOTIVES

1—Standard gauge, 10 x 16 Cylinder Porter, 4-wheel, saddle tank Locomotive; air brakes, automatic couplers, weight 19 tons.

1—Standard gauge, 13 x 18 cylinder American saddle tank Locomotive, air brakes, automatic couplers, side entrance cars, with rear fuel bunker; steam pressure 165 lb; weight 30 tons; built new 1911.

5—36-in. gauge, 10 x 16 cylinder Porter, 18-ton, saddle tank Locomotives, Shop Nos. 5065, 5235, 5302, 5304, 5305; extended saddle tanks, wide fire boxes, steam brakes and most modern design and equipment.

10—36-in. gauge, 10 x 16 Davenport American and Vulcan saddle tank Locomotives.

CLAPP, NORSTROM & RILEY EQUIPMENT CO.

12 and 14 South Canal St., Chicago

FOR SALE

LOCOMOTIVES

1—Consolidated 19 x 26 Standard gauge, 70-ton.
1—Consolidated 18 x 24 Standard gauge, 65-ton.
1—Vulcan saddle tank, 14 x 20, 40-ton.
2—Mogul, 36-in. gauge, 30-ton.
1—13 x 18 American saddle tank, standard gauge.
2—11 x 16 Vulcan 36-in. saddle tank.
4—10 x 16 Vulcan 36-in. saddle tank.
3—9 x 14 Porter 36-in. saddle tank.
1—Jeffrey 4½-ton 24-in. electric locomotive.

CARS

60—60,000 cap. box, standard gauge.
65—80,000 cap. gondola, standard gauge.
18—12 yd., 2-way, Western air dump.
42—4 yd. 36-in. gauge, steel underframe, 2-way dump cars.
10—1¼ yd. 34-in. gauge, 2-way dump cars.
7—1½ yd. 30-in. gauge Western 2-way dump cars.
1—Marion Model 61, 2½ yd.

SHOVELS

1—Marion Model 60, 2 yd.
1—70-C Bucyrus, 2½ yd.
1—Atlantic, 2½ yd.
2—Erie, type B, ¾ yd.
1—Marion Model 31, Caterpillar, 1 yd.
1—Bucyrus 18-B, caterpillar, ⅞ yd.

HOISTING ENGINES, BOILERS, ETC.

Thomas F. Carey Company
120 Liberty St., New York City.

A BIG SNAP FOR QUICK SALE

70,000 ft. 10 in. x 10 in. Georgia Long Leaf Pine Timbers, 30 ft. to 40 ft. lengths.
20,000 ft. 8 in. x 10 in. Georgia Long Leaf Pine Timbers, 12 ft. to 14 ft. lengths. All are "Heart" sticks.
100 tons, approximately, Bolts sizes from 1 in. x 7 in. to ¾ in. x 15 in.
80 tons, approximately, O. G. Washers 1 in. and ¾.
200 All Brass acidproof Globe and Gate Valves, 6 in. diam. to 3 in. Standard makes.
40—60,000 gal. Oregon Fir Tanks.

All the above is in A1 condition, ready for immediate shipment, subject to prior sale. Wire for prices and particulars.

Maryland Wrecking Co., Inc.
Box 176, Curtis Bay, Baltimore, Md.

DRAG LINES

1—Equipped with American 8¼ x 10 Special Drag Line Engine, 4 x 4 Swinging Engine, full circle Cable Swing, 60-ft. steel boom, 2-yd. Page Bucket, steel upper deck, boiler practically new, engine just overhauled, 14-ft. circle track, Skid & Roller type. Just finished job; can load at once. Price $8,500 f.o.b. Omaha, Nebraska.
1—90-Hp. Thomas Elevator Company Electric Cable Way Hoist, 2 Drum, 2 Speed and complete with two 1½-yd. Buckets, all Cable and Sheaves. Price $5,500 f.o.b. cars Central Minnesota.

REVOLVING SHOVEL

Thew Type O. Two Booms, ¾-yd. Grading Dipper on Horizontal Crowd Boom, ½-yd. Sewer Dipper on Shipper Shaft Boom, Shop No. 1164, Reflued. Minneapolis location. Condition excellent.
Also four R. R. Type Marions.

NEW CLAM SHELL BUCKETS.
IMMEDIATE DELIVERY

2—¾-yd. Lakewood Buckets, $480 each.
4—1-yd. Lakewood Buckets, $570 each.
2—1¼-yd. William Favorites, $750 each.
3—½ and ¾-yd. Hayward Orange Peel Buckets, $900 each.
4—Lee 5-ton Motor Truck Trailers Under Slung Platform, $1,080 each.
1—¾-yd. New Chain Belt Mixer, Gasoline Engine Side Loader, and Water Tank, $2,400.

All of the above Equipment New.
Location, Milwaukee

Industrial Engineering Company
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NEW

WATER TUBE BOILERS

Suitable for Marine or Stationary Purposes

Size 9 ft. x 10 ft.
1800 sq. ft. Heating Surface
500 lbs. Hydrostatic Pressure
250 lbs. Steam Pressure

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LITTLE GIANT CRANE

1—Full revolving Little Giant traction steam crane, ¾-yd. bucket. Immediate delivery.

THOMAS HEATLY
909 N. Franklin Street, Chicago, Ill.

RAILS

1000 tons first-class 40 lbs. relaying rails with angle bars. Location Georgia.

WELLER & COMPANY
Birmingham, Ala.

NEW—USED —REBUILT

CONSTRUCTION EQUIPMENT

FOR SALE OR RENT

ROAD ROLLERS

1—Buffalo-Pitts, 3-wheel, 10-ton, No. 9011, 18-in. rear rolls.
1—Buffalo-Pitts, 3-wheel, 10-ton, No. 8899, 18-in. rear rolls.
1—Kelly-Springfield, 8-ton, tandem, No. 3108, used only 30 days, like new.

PAVING MIXERS

1—Foote, cap. 27 cu-ft. dry material, No. 1,936, chute discharge, 26-in. wheels.
1—Koehring, 14E, cap. 22 cu-ft. dry material, A. S. M. E. boiler, boom and bucket, batch meter and unloading derrick; used few days.
1—Koehring, Old No. 14, cap. 14 cu-ft. dry material, boom and bucket; good order.
1—Ransome, 60-S, cap. 14 cu-ft. dry material, chute discharge; in good order.

CRUSHERS

1—Traylor, jaw 30 x 60.
1—Reliance, jaw 12 x 24.
2—Acme, jaw 11 x 22.
2—Climax, jaw 10 x 20.
2—Climax, jaw 9 x 16.
1—Champion, jaw 9 x 16.
Can furnish complete plants.
1—No. 8 Austin gyratory.
2—No. 6 Gates gyratory.
1—No. 5 Austin gyratory.
1—18-in. Symonds disc.

STEAM SHOVELS

1—Erie, type "B," ¾-yd. dipper, revolving, mounted on traction wheels.
1—Thew, type "O," No. 407, ⅝-yd. dipper, now working; is old but will sell reasonably.
1—Bucyrus 18-B ⅞-yd. dipper, revolving on traction wheels, used only 9 mos.

CARS

6—1½-yd. two-way dump, 24-in. gauge built by Western Wheel Scraper Co. Used very little.

ROAD CARS

4—Buffalo-Pitts, 20-ton cap, flat deck traction cars, road wheels 48-in. dia. x 14 in. face, platforms 8-ft. wide by 18-ft. long, reversible.
2—Buffalo-Pitts, 5-ton cap, or 3½ cu-yds., reversible, bottom dump trailers, 8-in. wheels.

STEAM TRACTORS

2—Buffalo-Pitts, 50-hp., specials, Nos. 10,005-10,006, rear mounted, 16 tons.
1—Buffalo-Pitts, 35-hp., special, No. 6032, rear mounted, cut steel gears.

ASPHALT PLANT

1—2-car Cummer 2,000-yd. daily capacity, ready for prompt delivery; fuel specifications on request.

MISCELLANEOUS

1—Buffalo-Pitts Scarifier.
6—Bottom Dump Wagons.
1—Haiss Wagon Loader.
1—Austin Road Grader.
1—600 gal. Studebaker Sprinkler.
2—500 gal. Asphalt Kettles.
1—10 cu-ft. Knickerbocker Mixer.
3—700-lb. Ing.-Rand Steam Hammers.
3—Porter 9 x 14, 36-in. ga. Locomotives.
17—1-yd., 36-in. ga. "V" Dump Cars.
2—36-in. ga. Plymouth Locomotives.
1,500 ft. 16-lb., 24-in. ga. Portable Track.
1—35-ton Standard gauge Locomotive.
1—30-hp. Farquhar portable Boiler, with engine mounted; 125-lb. steam.
1—Byers Autocrane, Type C, 30-ft. boom.
8—2-yd. 36-in. gauge, V body steel dump cars.
2—7 H.P. Waterloo back fillers.
3—65 H.P. steam engines.
1—30 H.P. steam engine.
1—15 cu. ft. Hayward orange peel bucket.
1—Koehring Mixer loader.

Inquiries Solicited

READING ENGINEERING CO., Inc.

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We aim to please

LOOK!

MIXERS MIXERS

We have just received two carloads of new one-bag concrete gasoline driven mixers, well-known make, built of material purchased before present big advance in costs. This allows us to sell them at bargain prices.

Immediate Delivery from Stock
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Power loaders............$1150
Low chargers............ 950

Easy terms. Get our plan.

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Contractors Construction Equipment
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Structural Steel For Sale

We offer for immediate shipment from stock our surplus stock, consisting of Beams, Channels, Angles, Plates, practically all sizes. Send us your inquiries.

CANTON BRIDGE COMPANY, CANTON, OHIO

FOR SALE

EQUIPMENT

Immediate Delivery

STEAM SHOVELS

1—Vulcan Little Giant type traction shovel, 1¼-yd. dipper, first class condition.
1—Model "28" Marion revolving traction shovel, ⅝-yd. dipper.
1—Model "28" Marion, ¾-yd. bucket with dragline attachment, including boom, bucket, extra drum and circle.

LOCOMOTIVES

2—11-in. x 16-in. Porter 36-in. gauge, steam brakes, 160-lb. steam.
1—Pittsburgh 40-ton standard gauge saddle tank locomotive, cyl. 16-in. x 24-in., good condition.
1—Lima 20-ton saddle tank locomotive, cyl. 10-in. x 16-in. steam brakes, 160-lb. steam pressure. First class condition.

CARS

16—12-yd. standard gauge Western dump cars.
1—Western standard gauge spreader car.

Also have other equipment, such as standard shovels, locomotive cranes, road rollers, concrete mixers, relaying rails, etc. Inquiries solicited.

THOS. J. DOLAN
76 W. Monroe St., Chicago, Ill.

2—**Fairbanks Dredges** 3½ yd., 90 ft. Boom.

1—14B **Bucyrus Dragline,** 2-yd. bucket, 60 ft. Boom.

1—No. 3 Clyde **Steam Log Loading and Skidding Outfit.**

1—**Dobbie Railroad Incline Conveyor and Tipple.**

30—4-yd. Standard **Western Dump Cars.**

20—1½-yd. **Western Dump Cars.**

3½ Miles 60-lb. **Rail.**

2½ Miles 30-lb. **Rail.**

4—**Revolving Steam Shovels,** ¾ and 1 yd. capacity.

2—18-ton **Vulcan Locomotives, first class** condition.

1—**Air Compressor,** 450 cu. ft. capacity, good as new.

1—60-Hp. **Foos Gas Engine.**

1—30-Hp. **Foos Gas Engine.**

6—**Paving Mixers** of the **Foote** and **Koehring** type.

1—Large lot 24-in. gauge 1½-yd. capacity **Koppel Cars.**

2—Large Stiff Leg **Steel Derricks.**

4—Double Drum **Hoisting Engines with** boilers.

1—**Block Scarifier,** good as new.

A full and complete line of Contractors' and Road Building Machinery

Central Equipment Company
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BOILERS

4—125 hp. Loco. type Portable Boilers, only 2 years old and in fine condition, 100 lb. steam pressure.
4—72 in. x 18 ft. Return Tubular Boilers, used less than one year, 125 lb. pressure.
2—72 in. x 20 ft. Return Tubular Boilers, used 6 years, Massachusetts specifications, 125 lb. steam pressure.

CENTRIFUGAL PUMPS

	Cap. Gals.
12-in. Fulton	3000
12-in. Worthington	4000
10-in. Morris	3000
6-in. Wickes	1200

Also Engines and Motors

Wickes Machinery Company
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One 40-ft. Pile Driver, 2 Pile Hammers, 1 Hoisting Engine, bed piece and rollers.

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UTILITY EQUIPMENT COMPANY
PITTSBURGH, PA.

Yards and Shop:
Rook, Pa.

Used and Rebuilt Contractors' Equipment

STEAM SHOVELS

2—"O" Thew.
1—Model 28 Marion. Traction.
1—Type "B" Erie. Traction.
1—Model 31 Marion. Traction.
1—Model 36 Marion. Caterpillar.
1—Model 40 Marion. Traction and standard gauge trucks.
1—Model 20 Marion. R.R. wheels. 1¼-yd. rock dipper. Tunnel or quarry.
1—Model 60 Marion. New Ohio boiler.
2—Model 250 Marion Stripping Shovels. 75-ft. boom. 3½-yd. dipper.
1—No. 3 Keystone Excavator.
1—No. 6 Keystone Excavator.
1—Type "C" Byers Auto Crane.

ROAD ROLLERS

1—3-w., 10-ton dble. cyl. Monarch. Shop No. 20020.
1—3-w., 10-ton dble. cly. Kelly-Springfield.
2—3-w., 10-ton dble. cyl. Buffalo-Pitts.
1—5-ton Tandem. Buffalo-Pitts.
1—10-ton Austin. Gasoline.

CRUSHING PLANTS

1—No. 2½ Climax. Elev. bins. etc.
1—No. 4½ Champion. Elev. bins, etc.
2—No. 10½ Acme. Elev. bins. etc.
1—No. 2 Gates Gyratory. Center discharge.
2—No. 5 Austin Gyratory. Straight drive.
1—No. 7½ Austin Gyratory. Left-hand drive.
1—No. 4 Champion on skids.
1—No. 4½ Champion. Manganese fitted.
1—No. 5 Champion on wheels. Mang.
1—No. 5 Champion and 1,000-ton bin.

ROAD EQUIPMENT

1—50-ton Galion Unloader. Complete.
1—Ohio Grader.
2—No. 2½ Western Wheel Scrapers.
6—No. 3 Western Wheel Scrapers.
4—Dump Carts. Steel bodies.
1—700-gal. one-horse Austin Sprinkler.

CONCRETE PAVERS

3—14 Koehring. Boom and bucket.
2—16 Koehring. Boom and bucket.
2—6A Foote. Chute discharge.
1—14 Lakewood. Boom and bucket
1—15 "Rex." Boom and bucket

CONCRETE MIXERS

1—½ yd. Ransome on trucks. Eng. and boiler.
1—½-yd. "Cube" Trucks. Gasoline.
1—1-Bag. Waterloo Trucks. Gasoline

CARS

4—1½-yd., 24-in. Gage, box bed. Western.
10 Each 1 and 1½-yd. 36-in. Gage. "V" shape.
30—4-yd., 36-in. Gage. Western.
25—4-yd., 36-in. Gage, K. and J.
10—12-yd. Stand. Gage. Western.

Everything for the Contractor—Give Us a Call
We Want to BUY Equipment—What Have You?

FOR SALE—SPECIAL

5—Holt Caterpillar Tractors, 60-40, latest improved, thoroughly overhauled, immediate shipment.

24—5-yd. Troy Trailers, thoroughly overhauled.

1—Model 28 Marion Revolving Traction Shovel, ¾-yd. dipper.
1—Baldwin consolidation, 20 x 24, 65-ton.
2—Class 7 Bucyrus drag lines 42-ft. boom 1-yd. bucket.
1—6-Wheel Switcher, 19 x 26, 60-ton.

Sales Agents, Western Wheeled Scraper Company
BECK & BABB
29 So. La Salle St., Chicago, Illinois

STEAM SHOVELS

1—A-O Thew steam shovel, on traction wheels, with ⅝-yd. dipper.
1—Model 18 Osgood Steam Shovel, on traction wheels, with ¾-yd. dipper.
1—No. 0 Thew Steam Shovel, on traction wheels, with ¾-yd. dipper combination boom, can be changed to shipper shaft.
1—Marion Model 28 Steam Shovel, on traction wheels, with ⅝-yd. dipper.
1—Model 3 Keystone machine, with extra clam shell bucket and extension boom.

ROAD ROLLERS

1—10-ton, 3-wheel Steam Buffalo Pitt, double cylinder, rebuilt and repainted.
1—10-ton, 3-wheel, steam Kelly Springfield, double cylinder, ready for delivery.
1—10-ton, 3-wheel, steam J. I. Case, cleaned and repainted.
1—10-ton Austin, 3-wheel, gasoline, rebuilt and repainted.
1—10-ton, 3-wheel gasoline, Kelly Springfield, fine condition.
1—6-ton Kelly Springfield, tandem, steam. Now being overhauled.
1—6-ton Erie, steam tandem, ready for delivery.
1—5-ton Universal, tandem steam, rebuilt, new flues and trimmings.

LOCOMOTIVES

2—Lima Shay 13-ton Locomotives, shop Nos. 2812 and 2826.

Concrete Mixers, Rock Crushers, Drag Lines, Asphalt Plants, Air Compressors, Cars and Rail, Cranes, Hoisting Engines, Trench Machines.

Midwestern Company
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Telephone Majestic 8356

For Sale Nearly New Road Equipment, Etc.

CONCRETE MIXERS

1—Koehring 18-E Paver, Steam.
1—Koehring 32-E Paver, Gasoline.
1—Rex 7-S with Loader, Gasoline.

GAS. LOCOMOTIVES, CARS, ETC.

2—Six-ton Whitcomb locos., 24-in. gage.
60—Western Wheel, 24-in. gage flat cars.
60—Western Batch Boxes.
4 miles 24-in. gauge Sectional Track, 25-lb.
2,000 lin.ft. Road Forms, Blaw.

CRANE AND PILE DRIVER

1—P & H Gasoline Caterpillar, 30-ft. Boom.
1—Railroad Pile Driver for 35-ton Type J Mc-Myler Locomotive Crane, cantilever construction.

ROAD ROLLERS, SUB-GRADERS ETC.

1—Austin Western 10-ton, 3-wheel, gasoline Roller.
1—Lakewood Sub-grader.
1—Lakewood Tamping and Finishing Machine.
1—Cleveland Tractor.

DECK SCOWS

1—500-ton, also suitable for Clam Shell Dredge.
2—17 x 40 and 20 x 40.

MORRIS CENTRIFUGAL PUMPS, ETC.

1—12-in. Split Shell. Water. Belted.
1—8-in. Sand. Direct-connected. Steam.
2—8-in. Water. Am. Well Wks. Pipe & Fittings. All Kinds.

STEEL PILING AND SKIPS

85—15-ft., 30-45-ft., 30-50-ft. U. S. Steel Piling, 35 lbs.
3—Steel Skips, 6 cu.yds.

JAMES O. HEYWORTH
Harvester Bldg., Chicago, Ill.

For Sale By Owners

The following equipment in first-class condition—in fact has just finished up large paving contract and is now ready for immediate delivery:

1—Hethering & Berner One-car
ASPHALT PLANT
capacity 1000 yd., 2-in. wearing surface, with extra dryer 3 x 12-in. built on an all-steel railroad car.

1—50-hp.
BUFFALO-PITTS TRACTOR

1—5-Ton Iroquois
TANDEM ROLLER

1—Ransom 2-Bag
CONCRETE MIXER

6—Briggs
TIP-OVER CARTS

1—8-hp.
GASOLINE ENGINE

Wire or write for prices.

The West Construction Co.
Chattanooga, Tenn.

Quarry Bargains

1—24 x 13 and 1—36 x 18 Farrell crusher, elevator screens, 2—100 hp. boilers and engines, etc.
1—No. 3 Gates and 1—No. 6 Allis-Chalmers crushers, elevator, screens, 150 hp. Ball steam engine.

FRANCIS E. B. O'BRIEN
Phone Spruce 2262
41 So. 15th St., Philadelphia, Pa.

SAVE!!—

LABOR—by using the right machine for the job
MONEY—by getting that job done on time
TIME—by putting on the job a machine that will keep going

We can help you in this saving by supplying reliable equipment, either new or rebuilt. Below is a partial list. Send us your inquiry now.

BOILERS

2—110 H.P. Return tubular, 125 lb.
1—30 H.P. Locomotive type on wheels, 100 lb.
1—25 H.P. Vertical, A. S. M. E. Standard.
1—20 H.P. Ames Vertical, 100 lb.

HOISTS

1—5½ x 10 Mundy D.D., D.C. with boiler.
1—7 x 10 Mundy S.D., D.C. with boiler.
1—7 x 10 Lidgerwood 3 D.D.C. with boiler.
2—8½ x 10 Lambert D.D., D.C. with boiler.
1—10 x 12 Lambert 3 D., D.C. with boiler.
1—8¼ x 10 National D.D., D.C. with boiler.
2—6¼ x 8 Rawson Morrison D.D., D.C. skeleton.
2—8¼ x 10 American D.D., D.C. skeleton with swinger.
1—10 x 12 American D.D., D.C. skeleton.

LOCOMOTIVES

2—3-ton Bell Locomotive, 24-in. gauge.
1—6-ton American, fuel oil burning.
3—18-ton Vulcan Saddle Tank, 36-in. gauge.
1—6-ton Bell, oil burning, standard gauge.
1—9-ton Bell, 4-wheel, Standard gauge, kerosene burning.
1—40-ton, 4-wheel saddle, Standard gauge.

COMPRESSORS

1—McKiernan, 800-ft., 20 x 20 x 24, straight line.
1—Ingersoll-Rand, 10 x 10, gasoline, 134 ft.
2—Ingersoll-Rand, 6 x 8, belt driven.
3—Clayton, 8 x 8, belt driven.

DERRICKS

1—Guy Derrick, mast 14 x 14 x 40-ft, boom 12 x 14 x 39-ft., 2 line.
1—Guy Derrick, mast 12 x 12 x 70-ft., boom 12 x 12 x 65-ft., 2 line.
2—Stiff leg derricks, 30-ft. mast, 35-ft. boom, 2 line.
1—Traveling derrick, 18-ft. gauge, 45-ft. boom, 7 x 10 Lidgerwood D.D., D.C. with boiler and geared swinger, ½ yd. Hayward bucket.

CARS AND TRACK

6—½ yd. Radial dump mine cars, 24-in. gauge.
20—1 yd. and 1½ yd. Koppel cars, 24-in. gauge.
28—1 yd. to 2 yd. Koppel cars, 36-in. gauge.
2,600 ft. 24-in. portable track 20 lb. rail.
10—tons 20 lb. relaying rail.

ROAD ROLLERS

4—10-ton Buffalo-Pitts 3 wheel.
1—10-ton Universal Tandem.
2—8-ton Buffalo-Pitts Tandem.
3—6-ton Buffalo-Pitts Tandem.
1—6-ton Kelly-Springfield Tandem.
1—5-ton Pioneer Tandem.
1—3½-ton Universal Tandem.
2—3-ton Pioneer Tandem.

STREET PAVERS

2—Koehring, cap. 22 cu.ft., dry, boom and bucket.
2—Cube, cap. 22 cu.ft. dry, boom and bucket.
1—Koehring, cap. 18 cu.ft. dry, boom and bucket.
1—Koehring, cap. 14 cu.ft. dry, boom and bucket.
1—14-E Smith, 21 cu.ft. dry, 16-ft. chute; new.

MIXERS

1—10 cu.ft. dry Oshkosh, power loader, gasoline.
1—14 cu.ft. dry Ransome, power loader, gasoline.
1—10 cu.ft dry Ransome, power loader, 220-v., D.C. Motor.
1—18 cu.ft. dry Ransome, power loader, 220-v., D.C. Motor.
1—21 cu.ft. Smith, batch hopper, steam engine only.
1—20 cu.ft. Ransome, steam engine and boiler, mounted on wheels.
3—Eureka Continuous Mixers, gasoline.

MISCELLANEOUS

1—No. 5 Leyner drill Sharpener.
2—No. 1 Union Pile Hammers.
1—No. 9 McKiernan-Terry Pile Hammer.
1—Hamilton Sheeting Hammer.
1—Barber-Green Loader, Buda Engine.
1—100-ton Buffalo Track Scale, 40-ft. platform.

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UNUSED WOOD PIPE FOR SALE

IMMEDIATE DELIVERY

5279 ft. 18 in. Class "C" Pipe
1406 ft. 14 in. Class "C" Pipe
1480 ft. 12 in. Class "C" Pipe
2438 ft. 10 in. Class "C" Pipe
1169 ft. 8 in. Class "C" Pipe
3239 ft. 6 in. Class "B" Pipe
2229 ft. 4 in. Class "B" Pipe

This lot at Racine, Wisconsin, stored in Government Warehouse since delivery.

Offered for sale at very attractive price for entire lot. Inspection before acceptance.

F. C. JUSTICE
Insurance Exchange Bldg.,
Chicago, Ill.

COMPRESSORS

2500 ft. WC Sullivan, steam.
1704 ft. XC-3 Ingersoll, steam.
1575 ft. ZA-2 Laidlaw, steam.
1190 ft. X-3 Ingersoll, steam.
862 ft. CCS Bury, steam.
396 ft. WB-2 Sullivan, steam.
386 ft. FR-1 Ingersoll, steam.
240 ft. CCSC Bury, steam.
92 ft. Westinghouse pump.
1190 ft. XB-2 Ingersoll, belt.
599 ft. XB-2 Ingersoll, belt.
307 ft. WG-3 Sullivan, belt.
216 ft. WG-3 Sullivan, belt.
179 ft. NE-1 Ingersoll, belt.
184 ft. N-SO Chicago, oil driver
96 ft. NE-1 Ingersoll, belt.
42 ft. NE-1 Ingersoll, belt.
23 ft. XII Ingersoll, belt.
150-hp. Manning boiler, 150-lb. Mass.

Also boilers, generating sets.

A. LEE ELLIS
10 High St., Boston, 9, Mass.

1—Marion **Shovel,** Model 28.
1—Osgood **Shovel,** Model 18.
2—Type C Byers **Cranes,** 35-ft. Boom.
1—Osgood Std. Ga. **Crane,** 40-ft. Boom.
1—15-ton McMyler, **Crane,** 4-wheel D.D.
Stiff Leg **Derrick,** 60-ft. Boom, 3-line.
2—6½ x 10 Mundy **Hoists,** 3-drum.
5—6½ x 10 Mundy **Hoists,** 2-drum.
1—½-yd. Ransome **Paver,** with Chute.
1—No. 9 Koehring **Paver** with Boom.

Above is partial list. Advise your needs. Sale or Rent. Phone or Wire.

C. G. A. SCHMIDT, JR.
639-41 Land Title Bldg., Philadelphia, Pa.
Spruce 4745-46

LOCOMOTIVE CRANES

For Immediate Shipment

2—Ohio, 25-ton, 8-wheel, M.C.B. 50-ft. boom, D.D. for clam-shell, three years old, very good condition.

1—American, 4-wheel, standard gauge, 30-ft. boom, single line, rebuilt, first class.

Moore Bros
REBUILT MACHINERY

39 So. La Salle Street, Chicago, Illinois

Gasoline Hoist

1—6½ hp. Domestic single drum gasoline hoisting engine. Used only a few weeks. $395 f.o.b. Chester, Pa. Also one 9 hp. Domestic gasoline engine.

E. H. WILSON & COMPANY
COMMERCIAL TRUST BUILDING
PHILADELPHIA

FOR SALE **IMMEDIATE DELIVERY** **FOR SALE**

SALVAGED MATERIAL

From Camp Stuart, Newport News, Va. All material in excellent condition.

6,000,000 feet LUMBER Rough and Dressed

Suitable for shoring, concrete forms and general building purposes.

Boards, Roofers, Flooring, 3-in. and 4-in. Novelty Siding, Doors, Sash, Transoms, Screens and Wall Board.
Large quantity of Framing in sizes 2 x 4 up to 12 x 14.

Also big stock of short dressed tongue and groove boards at a very attractive price. Especially suitable for concrete forms.

STORAGE TANKS

Used for storing hot water. Made of black sheet iron. Sheets ¼-in. thick and heads ³⁄₁₆-in. thick. Double riveted and tested to 200 lbs.

5-ft. x 24-in., 120 gals. cap.
5-ft. x 30-in., 180 gals. cap.
5-ft. x 36-in., 210 gals. cap.
6-ft. x 42-in., 430 gals. cap.
6-ft. x 48-in., 525 gals. cap.

COMPLETE PUMPING STATION

consisting of the following equipment

3—Circular Redwood Tanks 44-ft. in diameter with 18-ft. staves, covered, capacity of each about 200,000 gallons. Elevation of water level when the tanks are full is 55.6.

Pumping Equipment:

1—Worthington Centrifugal Pump 750 G.P.M., 8-in. suction, 6-in. discharge, driven by G.E. Motor, 100-hp., 1760 R.P.M.

1—Allis-Chalmers Centrifugal pump, 1000 G.P.M., 6-in. discharge, 6-in. suction, 160-ft. head; driven by Fairbanks-Morse 75-hp. 1750 R.P.M.

1—Platt Iron Works Centrifugal Pump 1000 G.P.M. 160-ft. head, 6-in. suction, 6-in. discharge; driven by Fairbanks-Morse Motor, 75-hp., 1750 R.P.M.

1—6 x 6 Van Blerck Motor with Leece-Neidle Electric Starting Equipment, direct-connected to pump. To be used should electric current fail.

1—Venturi Meter (Builders Iron Foundry), 8-in. x 3¼-in. capacity, 1.4 M.G.D.

At this station are the controls for the electric service in Camp Stuart and the Embarkation Hospital. There is also a Wallace-Tiernan solution chlorine apparatus used for chlorinating all water passing through the station.

Complete stock of Power Plant Equipment, Electrical and Pumping Material too large to be listed.

ATLANTIC SALVAGE COMPANY, Newport News, Va.

FOR SALE

IMMEDIATE DELIVERY

One NEW 25-ton, eight-wheel, MCB, double drum, Ohio Locomotive Crane, equipped with full steel cab, steam brakes, 50-ft. structural steel boom. This crane has a 54-in. 150 lb. pressure boiler, good for any state in the Union; 10 x 10 engines, etc. We can also supply new generating set, magnet and bucket for this crane, if desired. An Erector will be supplied with this crane for one week, to put crane in operation and instruct your operator.

One USED 15-ton, four-wheel, double drum, Browning Locomotive Crane, equipped with 40-ft. steel boom. This crane has 54-in. boiler, 8 x 10 engines—the last boiler inspection in November allowed 140 lb. pressure on this boiler. Crane in very good condition. It can be inspected at Pittsburgh. This crane can be loaded for shipment at once. Will also consider renting this crane.

One USED 10-ton, 40-ft. span Hand Operated Case Crane, all movements operated by crank from platform hung at one end of crane. Ideal for hot metal work.

Five Thousand (5,000) first class Bolts, which have never been used, 1¼ x 7½ in. under head, total length 8½ in.; bolts have square heads and cold punched hexagon nuts. These bolts are offered at a real bargain.

We own all of the equipment listed.

THE FACTORY PRODUCTS COMPANY
203-204 Oliver Bldg., Pittsburgh, Pa.

POWER EQUIPMENT

AIR COMPRESSORS

Steam and belted, 100 lb. working pressures, 250 to 2500 ft.

BOILERS

Tubular and Vertical, all sizes, 10 to 150 hp.

ENGINES

Corliss, Plain and Vertical. All sizes, special bargains on Corliss stock.

HOISTS

Steam and Electric.

Ask for our stock sheet of strictly first-class used machinery.

LANDRETH MACHINERY CO.
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Air Compressors

1—18-in. x 20¼-in. x 13¼-in. x 18-in., two stage (steam), capacity 1115 cu. ft. "Ingersoll-Rand."

1—20-in. x 12½-in. x 16-in. (belted), capacity 950 cu. ft. "Sullivan."

1—16-in. x 18-in. x 11-in. x 16-in., two-stage (steam). Capacity 706 cu. ft. "Sullivan."

Also a large line of both smaller and larger compressors.

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Gasoline **Compressor** 100 cu. ft. on wheels.
½-yd. **Concrete Mixer** on wheels.
¾-yd. **Concrete Mixer** on wheels.
Sheath Pile Hammers.
Concrete Buckets.
15 cu. ft. Hayward **Orange Peel Bucket.**
2-yd. Hayward **Clam Shell Bucket.**
9½ x 12 **Lambert Cableway** complete.
15-ton **Stiff-Leg Derrick** complete with 12 x 12 Hoister and Independent Swinger.
Diving Gears.

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New Equipment

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2—Chicago Pneumatic Air Compressors, size 15 x 10, 1022 cu.ft. Free Air. 50 lb. pressure.

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1—100 H.P. Crocker-Wheeler Motor, 750 R.P.M., 25 cy., 3 ph., A.C. 220 vo.

1—75 H.P. Crocker-Wheeler, 750 R.P.M., 25 cy., 3 ph., A.C. 220 vo.

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NEW WATER TUBE BOILERS!

Purchased from

THE EMERGENCY FLEET CORPORATION
HEINE COLVIN and Other Standard Makes

250 H.P. 300 H.P. 325 H.P. 350 H.P. 400 H.P. 500 H.P.

Now Available for Immediate Shipment

A STUPENDOUS PURCHASE JUST COMPLETED

This big purchase from the United States Shipping Board, Emergency Fleet Corporation brings us the entire surplus stock of new high grade Water Tube Boilers. We are now about to offer an unusually attractive proposition to everyone interested in highest quality Steam Power Equipment. All boilers are built under rigid Government supervision and under the inspection of Lloyd's, American Bureau and United States Steam Boat Inspection Service. All boilers are perfectly adapted for land or marine purposes and are good for 200 lb. pressure or more. They are all steel encased and self-contained—adapted to hand firing or stoker application. Oil burning, coal burning or gas burning.

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Competent engineers are ready to serve you and lend their assistance in the installation of your Steam Power Equipment.

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20-in., 15-in., 12-in. and smaller—Prompt shipment. Prompt deliveries. Inquiries solicited.

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Threaded and coupled, cut to sketch.

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For storage, pressure, steam.

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Relayers and cut to length for contractors' use.

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16—7 x 10 double drum **Stroudsburg Engines** fitted with link motion. Drums 24-in. x 24-in. with rear one having concave ends for transversing line.
32—**Oregon Pine Masts** 72-ft. to 92-ft. long. Average diameter 17-in.
50,000 ft. ⅝-in. 6 x 19 C. S. **Wire Cable.**
15,000 ft. 1⅜-in. 6 x 19 C. S. **Hauling Wire Cable.**
50,000 ft. 1¼-in. **Cableway Wire Cable.**

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BOSTON, MASS.

PIPE SECOND HAND

With new threads and couplings; also cut to sketch.

PFAFF & KENDALL
Ferry & Foundry Sts., Newark, N. J.

ALBERT & DAVIDSON, Inc.

FOR SALE Second-Hand and NEW

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Large Stock
All Sizes
Threaded and with Couplings
Also Cut to Sketch

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We have purchased large quantities of pipe from various Government Plants, slightly used, sizes 1 in. to 12 in., inclusive, and can offer same at attractive prices. Your inquiries solicited.

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LARGE STOCK. ALL SIZES.

IMMEDIATE DELIVERY

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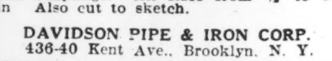
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New and second-hand. With new threads and couplings. All sizes from ½ to 12 in Also cut to sketch.

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LOCOMOTIVE CRANES

1—8¾-ton Industrial, 4-wheel, 35 foot boom, bucket operating drums.
1—15-20-ton Brownhoist 8-wheel M. C. B. 54-in. dia. butt strapped boiler, 50-ft. boom, bucket operating drums.
1—20-ton Industrial Works Co., 8-wheel, M.C.B., 50-ft. boom, bucket operating drums.
1—30-ton Browning, 8-wheel, M.C.B. bucket operating drums, Type No. 3.

BYERS AUTO CRANE

1—Late type on Traction Wheels, 30-ft. Boom, ¾-yd. Bucket. Machine like new, in condition.

REVOLVING TRACTION SHOVELS

1—Marion Model 31, on crawling traction.
1—Marion, Model 31, 1-yd. dipper, shop No. 3068.
1—Marion Model 28, ¾-yd. dipper; shop No. 3678.

LOCOMOTIVES

American 6-wheel switcher. Cylinders 18 x 24-in. Drivers, wheel base, 11-ft. 6-in. Weight on drivers, 120,000 lb. Carries 150 lb. steam. Excellent condition. Just out of shop.
1—Baldwin, standard gauge, saddle tank, 30-ton, type 0-4-0.

ROAD ROLLERS

1—Good Roads Machine Co. 10-ton tandem Steam Roller.
2—Monarch, Steam, 3-wheel, 10-ton.
1—Iroquois, Steam, 2½-ton tandem.

BOILERS

1—30 hp. locomotive type portable boiler and engine mounted on iron wheels with engine mounted on top of boiler.
1—50 hp. fire box, locomotive type, 100 lb. pressure.
1—70 hp. fire box, locomotive type, 100 lb. pressure.

CONCRETE MIXERS

2—Smith, ½-yd. machines, no power, have large stationary batch hopper.
2—Smith No. 1 gasoline driven, on trucks.
2—Smith No. 11 steam driven, on trucks with side loaders.
1—Cube No. 11 steam driven, on trucks with side loader.
6—Cube No. 17 steam driven, on trucks with side loaders.

CARS

4—¾-yd. capacity, V-shaped, all steel two-way dump, 18-in. gauge.
1—1-yd., V-shaped, all steel, two-way dump, 24-in. gauge.

CABLE

1840 feet, 1 piece, 2-in. locked wire cableway rope. Good as new.

DRAGLINE

1—3-T Monighan steam dragline, 60-ft. boom. Machine is balanced so that it will carry a boom eighty-five feet in length with a 2½-yd. bucket.
1—Lidgerwood-Crawford, Class B, all steel dragline machine, with 60-ft. boom and 1½-yd. Page dragline bucket. Fully overhauled, guaranteed good condition.

AIR COMPRESSORS

1—Ing.-Rand Class J, two-stage cylinders 9¼ x 8 and 14¼ x 8. Machine arranged for direct drive by motor. Requires 35-H.P. motor. Capacity 215 cu.ft. free air per minute at 100 lbs. pressure.
1—Gardner duplex steam driven, size 10 x 10 x 12, capacity 326 cu.ft. free air per minute at 100 lbs. pressure.
1—Norwalk two stage, steam driven air cylinder 17½-in., steam cylinder 24-in., stroke 30-in., 1659 ft. of air at 100-lb.

PUMPS

1—Morris 10-in. Belted Sand Pump.
1—Swaby, direct connected to steam engine 6-in. suction, 5-in. discharge.

TANK

1—Low pressure or storage tank, 6-ft. x 14-ft.

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1—60 hp. Puget Sound, extra heavy double cylinder, double drum hoist, with boiler, all steel gears. Make good log loader or hoist for heavy derrick work.
2—Byers, 16 hp. double cylinders, double drum, equipped with boilers, swinging gears.

MINE AND CABLEWAY HOISTS

1—Flory Skeleton, 8¼ x 10 D. C., D. D. link motion, with quadrant.
Lambert, 10½ x 12, double cylinder, single drum, 36-in. diameter, 24 in. face. Drum grooved; will take up ⅞-in. cable. Drum flanges 8 in. deep. Link motion.
Flory 10 x 12, double cylinder, double tandem drum engine, drums 40-in. diameter, 40-in. face. Operating levers banked in quadrant.

BUCKETS

1—1¼-yd. clamshell bucket.
1—¾-yd. Orange Peel, 3 blades, for rock work.
1—1-yd. Clamshell Bucket.

STEAM PILE HAMMER

1—Crane Steam Hammer equipped for round piles, total weight about 8000 lb. Weight of Ram 5500-lb.

PIPE

1450 feet 6-in.
4700 feet 4-in.
2500 feet 2-in.
4550 feet 1½-in.

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For Sale and Immediate Delivery

Two Hydro-Electric Units

each consisting of

One I.P. Morris, 5400 H.P. vertical shaft turbine, 300 RPM, under 130 ft. head. Volute casing, shaft, bearings, governor, complete with pumping system and hydraulically operated pivot valves.

One General Electric Co. ATP 10-pole, 4500 KVA, 3-phase, 25-cycle, 11,000 V, 300 RPM, continuous rated (3825 KW 85% power factor) vertical type, water wheel driven generator, arranged for direct connection. Generator furnished with upper and lower guide bearings, with G. E. spring thrust bearing with cooling coils, base, shaft, with forged coupling, stairway; with MPC 6-pole, 80 KW, 300 RPM, 125 V compound wound direct connected exciter.

Switchboard complete with all necessary instruments, voltage regulators, synchronizing apparatus, etc., also 5 feeder panels.

Full description, drawings and specifications will be furnished to the purchaser.

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International Paper Company
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1-in. to 6-in.

With New Threads and Couplings.

"We Test Our Pipe"

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Hoisting Engines
Austin Trenching Machines and Back Fillers
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1—100 H.P. Economic; first-class condition; now in use; price $1,000.

BELMONT-GURNEE STONE CO.
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NEW AND USED STORAGE TANKS

We have for prompt shipment, 30 New and Used Horizontal Storage Tanks, from 1000 to 30,000 Gallons, tested from 20 to 50 lb. pressure. We herewith mention a few sizes:

6—7 x 30 9,000 Gallon Tanks, New.
4—7 ft. x 35 ft. 10,500 Gallon Tanks, New.
3—10 ft. x 19 ft. 3 in. 12,000 Gallon Tanks, New.
4—66 in. x 26 ft. 4,450 Gallon Tanks, Used.

10—10 ft. 8 in. x 29 ft. 5 in. 19,200 Gallons, New.
1—6 ft. x 24 ft. 5,075 Gallon Tanks, Used.
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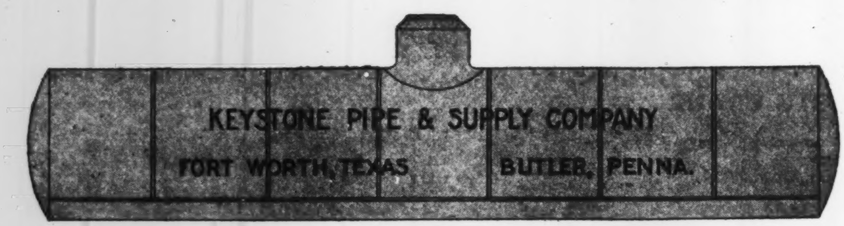
Every tank guaranteed.



Immediate Delivery

BOILERS

4—78-in. x 18-ft. A. S. M. E. Return Tubular Boilers, quadruple butt-strapped riveted, 175-hp. each.
6—72-in. x 18-ft. A. S. M. E. Return Tubular Boilers, triple butt-strapped riveted, 150-hp.

FEED WATER HEATER

STACKS

2—90-ft. x 48-in., ¼-in. plate.
1—80-ft. x 42-in., ¼-in. plate.

PUMP

1—Deane of Holyoke 16-in. x 10¼-in. x 18-in. Tank Service Pump.

DERRICK

1—Complete Coal or Stone Unloading Derrick, consisting of latticed steel mast and boom, 1½-yd. clam-shell bucket, 10 x 12 D.D., D.C. Haiss high-speed engine.

The above equipment may be inspected at 450 Greenpoint Ave., Brooklyn, N. Y.

RELAYING RAILS

Approximately 700-tons. Original 48-lb. relaying rails with angle bars. Immediate shipment.

A large tonnage of rail for structural and concrete reinforcing purposes.

35-ton 65-lb. A. S. C. E. Relaying Rails.

Complete with bars to match

M. C. FAIRCHILD & CO., Inc.
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725 Central National Bank Bldg.
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New Marion Model 31 STEAM SHOVEL on caterpillar tractor, for July 15 delivery.

Used, but Guaranteed
EQUIPMENT, MACHINERY and TANKS

Send Inquiry Before Buying or Selling

SHIPMENTS OF MIXED INDUSTRIAL SCRAP AND RAIL WANTED

WE PURCHASE
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AUSTIN EXCAVATOR

Model 00—shop No. 321, gasoline engine, caterpillar drive. Cuts 10 ft. deep. 22 in. or 27 in. width. Now Clayton, Delaware. Completely overhauled—ready for immediate use.

TRENCH EXCAVATING CORPORATION
c/o Benjamin Catchings,
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"United" Pumping and Mining Machinery

3—Pomona Deep Well Pumps.

1—3-in., two stage, Horizontal Centrifugal Pump.

1—3-in., two stage Cameron Turbine, Belt Driven Pump.

1—3-in., two stage, Vertical Centrifugal Pump.

1—10-in. Cameron Double Suction Volute with extended base for motor, 3,500 GPM, 64-ft. head.

15—Duplex Steam Pumps, 2 to 7-in.

1—Double Engine Cage Hoist.

United Iron Works, Inc.
Joplin, Missouri

FOR SALE

COMPLETE MACHINERY

including a frame and boom of 4 yard clam shell dredge. Also one 5½ yard dipper dredge.

Auten Engineering & Contracting Co., Incorporated
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20-in. Hydraulic Dredge

With pipe and a lot extra parts.
Now operating at Detroit, Michigan.

THE CENTRAL DREDGING CO.
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Mohawk Dredge & Dock Co.

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Second-hand and Rebuilt Plant

FOR SALE

Guy Derricks complete, 75 ft.
Lambert K2 Holding Drums.
Dipper Dredge, 2½ C.Y., with dp. scows.
16-in. Suction Dredge.
Derrick Boats.
Road Grader.
Concrete Buckets, 2 and 1¼ cu.yd.
Concrete Mixers.
Centrifugal Pumps, 12-in. belt drive.
Steam Shovel, Model 20 Marion.
40—4 C.Y. Skips, located Boston.
Other Small Plant.

Write for plant needed. We can rebuild or equip what we have to suit your wants.

Large size Parsons

TRENCH MACHINE

for sale, size 78, on traction wheels; machine overhauled; can be inspected; ready for shipment. Price $3,500 cash.

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Parsons—Large Size

TRENCHING MACHINE

Potter

BACKFILLER

with Boom—Austin

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FLOATING STEAM DIGGER AND DERRICK

with Clamshell or Orange Peel bucket attached.

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Let us help you plant that job. Wire or write your requirements. We will be pleased to quote the nearest we have.

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1—700-ton, 104-ft. x 34-ft. x 9-ft.
1—300-ton, 80-ft. x 22-ft. x 8-ft.
1—Iron, 70-ft. x 17-ft. x 5½-ft.
2—67½-ft. x 22-ft. x 6½-ft.
1—80-ft. x 28-ft. x 7-ft. Coal Scow.

DERRICK BOATS

1—82-ft. x 28-ft. 6-in. x 9-ft. "A" Frame Derrick Boat, 60-ft. boom.
1—65-ft. x 32-ft. x 5-ft. "A" Frame Derrick Boat, 72-ft. boom.
2—60-ft. x 17-ft. 6-in. x "A" Frame Derrick Boats, 50-ft. boom.

SUCTION DREDGES

1—20-in. Hull, 120-ft. x 36-ft. x 10-ft., digs 35-ft. deep.
1—16-in. Hull, 97-ft. x 33-ft. x 10-ft., equipped 44-ft. ladder.
1—12-in. Suction Dredge.

STEAM TUGS and GASOLINE BOATS

1—51-hp. Gasoline Tug, 42-ft. x 11½-ft. x 3-ft. 3-in. draft.
1—Gasoline Towing Launch, 30-ft. x 7-ft. beam.
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1—4-stand Submarine Drill Boat, machinery all complete.

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1—4¾-yd. Hull, 90-ft. x 36-ft. x 16-ft. Digs 42-ft. deep.
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1—3-yd. Hull, 86-ft. x 32-ft. x 10-ft. Digs 26-ft. deep.

DUMP SCOWS

3—650 cu. yds., 125-ft. x 34-ft. x 12-ft.
6—235 cu.yds., 95-ft. x 28-ft. x 8-ft.

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PAVERS and CONCRETE MIXERS

1—3-bag Batch Austin Cube. Boom and bucket.
1—14-cu.ft. Rex. With chute.
1—½-yd. Koehring Mixer. Steam, with side loader.
1—1-bag Batch gasoline mixer.
1—3-bag Batch Rex paver, with boom and bucket. Rebuilt 1919. Fine.

ROAD FINISHING MACHINE

1—Lakewood Finishing Machine. For 18-ft. road. 2½-in. crown.

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1—6¼ x 8 Lidgerwood, D.C., single fixed drum, skeleton swinger.
1—5½ x 8 "Contractors'" D.C., D.D., skeleton.

BUCKETS

1—3½-yd. Dredge Bucket, Manganese fittings, BRAND NEW.
1—1½-yd. Williams Clam Shell.

BOILER

1—30-hp. Upright.

ROAD FORMS

3500-ft. Blaw-Knox 6-in. side forms. Used on one job.
24-in. Gauge Cars.
14—1-yd. Easton scoop cars. Full revolving.

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1—16-in. x 16-in. x 70-ft. Mast, 60-ft. Boom, 14-ft. Steel Bull Wheel. All steel fittings and guy wires. Not bucket operating.
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STEAM SHOVELS

1—41 Marion on railroad trucks.
1—40-R Bucyrus on railroad trucks.
1—Type O Thew.

CLAM SHELL HOISTER

1—Hoisting Rig. Operating a 2½-yd Clam Shell Bucket. Engine etc. all mounted on broad gauge track.

CABLEWAY DRAGLINE

1—9 x 12 Lidgerwood Engine ASME Boiler, 50-ft. tower; 1½-yd. manganese fitted bucket; sheaves and cable for 600-ft. New 1919. Perfect shape.
1—400-ft. Span Lidgerwood Stationary Cableway, 8¼ x 10 D.C., D.D. Engine. 24-hp. Boiler. Towers 35-ft. high.
2—800-ft. Span Lidgerwood Stationary Cableways, 10 x 12 D.C., D.D. Engines. With 1 boiler only. No towers.

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CORRUGATED SHEETS

Item	*Quantity*
Corrugated Sheet Iron (9 ft. 6 in. x 17 ft. 9 in., 12 ga.)	300 pieces
Corrugated Sheet Iron (13 in. x 50-in., 20 ga.)	9,600 "
Corrugated Sheet Iron (26 in. x 4 ft. 6 in., 16 ga.)	2,417 "
Corrugated Sheet Iron (25 in. x 4 ft. 6 in., 16 ga.)	4,918 "
Corrugated Sheet Iron (13 in. x 50 in., 20 ga.)	5,750 "
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The above material is painted O.D. color, is of the highest grade, is new and in perfect condition, ready for use. Packed in bundles suitable for shipment. Has the necessary accessories to erect such as angles, clamps, sleepers, bolts, plates, etc.

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Spot Ex Warehouse New York

1000 Tons Mild Steel Reinforcing Bars, Rounds ¼ in., ⅜ in., 5/16 in., ½ in.

250 Tons, 16 lb., New Rails
150 Tons, 25 lb., New Rails
Complete with Angle Bars, Bolts and Nuts.

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Good Condition, Right Prices

2—Lidgerwood Hoisting Engines D.C. 7 x 10, D.D., boilers.
8—Mundy Hoisters, D.C. 7 x 10, S.D. skeleton.
Austin Street Sweeper.
Austin Road Machine.
2—Stiff-leg Derricks, 10 ton.
1¼-yd. Williams Clam Shell.
1/3-yd. Hayward Orange Peel.
10-ton, 3-wheel Peerless Steam Road Roller.
5-ton Kelly-Springfield tandem Road Roller.
No. 1 Union Steam Pile Hammer.
No. 4 Union Steam Pile Hammer.
No. 5 Union Steam Pile Hammer.
No. 14 Ransome Paving Concrete Mixer.
½-yd. Cube Builders' Concrete Mixer.
9—C. H. & E. Saw Rigs. Cheap.
2—Steel Blocks, 3—16-in sheaves. New.
5-ton Motor Truck. Very cheap.
1—Jack Hammer Drill.
5—Hand Power Diaphragm Pumps.
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Miscellaneous lot of small tools.

LEWTER F. HOBBS
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1—Cummer 1800-yd. Road Asphalt Plant.
1—Iroquois 800-yd. Road Asphalt Oil Burning Plant.
1—Noyes Crusher for Re-Working Old Asphalt.
1—Good Roads Mach. Co., 10-Ton Tandem Steam Roller.
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2—Monarch 10-ton 3-Wheel Steam Rollers.

New full Revolving, Self Propelling Traction Road Cranes.

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4—No. 6 GATES (MANG.) NICKEL STEEL SHAFT. $2,500 EACH.
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Locomotive Type Boiler, 90 HP.
Air Compressors (Steam, Belt), 50-400.
40 Boilers, 60-150 HP., 100-150 lb.
1—30-60 Emerson Brantingham Tractor.
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1—5D Gates Crusher (Reg. Drive).
1—7½ Austin Crusher (Reg. Drive).
Gasoline Locomotives—Pavers—⅝-in. cable Engines, Contractors' equipment, etc.
2—Car loads piping, 2 x 12-in. valves, fittings, etc., 65% present prices.

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PAVING MIXERS

Foote 6-A, steam operated. Cap. about 23 cu. ft. loose. Thoroughly overhauled. Price $2500. Phila.

Milwaukee Style "G," steam operated. Cap. about 21 cu. ft. loose. First-class order. $2150. New York.

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All of these pavers have two-way traction device, automatic charging loaders, water tanks, etc. Chute discharge (not boom and bucket) on all three.

We have several others, including such well-known makes as KOEHRING, REX, etc. Send us your inquiries.

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Koehring **Street Paver**, No. 14, with boom and bucket.
⅝-yd. **Thew Steam Shovel.**
2—Climax 2½ **Crushers.**
35-Ton **bins, elevators** and **screens,** all mounted.
1—Adams **Combination Road Scraper and** Scarifier.
6—Gasoline **Water Pumps**, various sizes.
1—Studebaker 600 Gal. **Sprinkler.**
2—Size 20 Milwaukee **Pavers** with boom and bucket.
1—Climax Jumbo Road Machine.

E. McGREEVY
309 Robinson Bldg., Elmira, N. Y.

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1—10 Ton IROQUOIS ROLLER

in first class condition

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2—No. 16 Koehring Street Paving Mixers.
3—No. 14 Koehring Street Paving Mixers.
2—13-E Foote Street Paving Mixers.
1—6-A Foote Street Paving Mixers.

ROAD ROLLERS

3—10-ton Buffalo-Pitts 3-wheel Road Rollers.
3—6-ton Buffalo-Pitts Tandem Road Rollers.

EXCAVATORS

3—No. 3 Keystone Excavators, ½-yd. Skimmer Scoop, in first class condition.

STEAM SHOVELS

1—No. 0 Thew ⅝-yd. Traction Steam Shovel.
1—A-1 Thew ¾-yd. Traction Steam Shovel.

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FOR SALE

Four 10-ton flexible cross reach

ENGINE WAGONS

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305 lineal ft. Conveyor Track, on stands.
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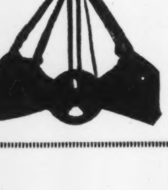

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1—Dodge Friction Clutch, 50-hp., 18 in.

Compressors

1—14 x 12 Sullivan Compressor, Class W.G. 3.
1—14¼ x 10 Ingersoll-Rand Compressor, Class N.E. 1.
1—10½ x 12¼ Ingersoll-Sergeant Duplex Corliss Compressor, pressure 110 lb., 100 r.p.m., 780 cu.ft. free air displacement.

Conveyors

Large Assortment.

Crushers

1—No. 4 Gates Gyratory Crusher, 200 tons capacity, 8 hours.
1—24-in. Symons Disc Crusher, 175 tons to 2-in. ring, 8 hours.

Drying Cabinet

1—8-compartment steel sample Drying Cabinet, steam heat.

Elevators

16 to 65-ft., steel and wood casing.

Filter

1—Moore Filter, manufactured by Stearns Rogers Mfg. Co., 400 to 500 tons per 24 hours.

Filter Presses

2—24 x 30 Stearns-Rogers Filter Presses.
1—24 x 24 Vulcan Filter Press.

Hoists

1—7 x 10 Hendrie & Bolthoff Quadruple Friction Steam Hoist.
1—12 x 12 Lidgerwood Cableway Hoist, with two drums.

Magnetic Pulley

1—18 x 18 Cutler-Hammer Magnetic Pulley.

Motor Car

1—4-ton Motor Car, equipped with two 5-hp., P.D.C. motors, railroad type, complete with controller and resistance, 45 per cent bottom; door arranged to dump material slowly or all at once as desired.

Motors

3-phase, 30-cycle, 440-volt, 2 hp. to 100 hp.

Ore Feeders

1—30-in. Champion Ore Feeder, belt driven.
1—Plunger Ore Feeder.

Pulleys

Wood, steel and cast. Large assortment.

Pumps

1—4-in. Centrifugal Pump.
1—6-in. Centrifugal Pump.
1—3-in. Centrifugal Pump.
1—1½-in. Centrifugal Pump.
1—Deming Triplex Pump, 4 x 4.
1—2¾ x 6 Dean Triplex Pump (high pressure).
2—5 x 10 Buffalo Triplex Pumps.
2—8 x 10 Buffalo Vacuum Pumps.

Radiator Units

209—Mill Radiator Units, 30 x 12 x 3.

Receivers

1—3½ x 8 Air Receiver, for 100 lb. pressure.
1—2 x 6 Air Receiver, for 100 lb. pressure.
1—4 x 12 Air Receiver, for 250 lb. pressure, ⅜ steel.

Rolls

3—14 x 27 Allis-Chalmers, Type B Rolls.
1—14 x 30 Denver Engineering Co. Roll.
1—12 x 30 Walker Mfg. Co. Roll.
1—9 x 7 Walker Mfg. Co. Roll.

Samplers

1—24-in. Vezin Sampler.
1—30-in. Vezin Sampler.

Screens

1—4 x 5 Colorado Iron Works Impact Screen.
3—4 x 4 Colorado Iron Works Impact Screens.
1—40 x 120 Smith Rotary Screen
3—3½-ft. Bunker Hill Screens.

Shaking Pans

3—Denver Engineering Co. Shaking Pans, roll feeders.

Tables

1—Deister Concentrator Co. Sand Table.
12—Deister Concentrator Co. Slime Tables.

Tanks

2—Steel Tanks, 8 ft. dia., 10 ft. high, 3/16 in. flat bottom.
2—Steel Tanks, 16 ft. dia., 16 ft. high, 3/16 in. flat bottom.
2—Steel Tanks, 18 ft. dia., 16 ft. high x ¼ in., 45 per cent cone bottom.
3—Steel Tanks, 20 ft. dia., 16 ft. high, 3/16 x ¼ in., no bottom.

Thickener

1—34-ft. Dorr Thickener Mechanisms and Wood Tank, 34 x 12 ft.

Tube Mills

1—5 x 16 Denver Engineering Co. Tube Mills, complete.
3—5 x 16 Stearns-Rogers Co. Trunnion Type Tube Mills.

THE REBUILT MACHINERY CO.
Colorado Springs, Colo.

REBUILT MACHINERY

15—8 to 50-hp. **Vertical Boilers**
14—50 to 125-lb. **High Pressure Boilers.**
6—150-hp. **High Pressure Boilers.**
10—**Air Compressors,** all sizes
30—**Rock Drills,** all makes
10—**Ingersoll Water Leyner.**
10—**Blake Crushers,** all sizes.
15—Sets **Cornish Rolls.**
25—Duplex **Steam Pumps,** all sizes.
15—Single and 2-Stage **Centrifugal Pumps.**
5—Complete **Deep Well Pumps.**
20—5 to 150-hp. **Gas Engines.**
1—Lot **Steam Engines.**
3—Large **Corliss Engines.**
25—**Hoists,** all makes.

Other items too numerous to mention. Inquiries solicited from Mines, Cotton Gins, Refineries and Rock Crushers.

Wire or Write

E. A. MARTIN MACHINERY CO.
5th and School Sts., Joplin, Mo.

For 52 pages of unusually good bargains in

Contractors' Equipment

Rails, Cars, Locomotives, Boilers, Engines, Pipe, Piling, Tanks, Etc.

Write for Our Latest Big Bulletin.

ZELNICKER IN ST. LOUIS

LIGHTER FOR SALE

A-frame, steam digger Derrick Lighter, 10 ton lifting capacity; can handle clamshell or O.P. bucket; hull, 34 x 98 x 8 (car float). Located Bridgeport, Conn.
Also 6 x 8 D.D., D.C. **Lidgerwood, with boiler.**
1—3½ **Dake.** 1—½-cy. **Clamshell.**
2000 ft. 2 in. used **W. I. Pipe.**

HUGHES & GRAY
Smith Bldg., Greenwich, Conn.

OVERHEAD TRAVELING CRANES

Two Morgan 30-ton, 50-ft. span

Main Hoist 50 H.P.	Bridge 25 H.P.
Auxiliary Hoist 30 H.P.	Trolley 5 H.P.

Westinghouse Motors 220 Volts D. C.

F. MAYER, 737-738 Monadnock Bldg., Chicago, Ill.

FOR SALE

STEEL SHEET PILING

150 Pieces new, unused Lackawanna Piles 12¾-in. x ⅜-in. Steel Sheet Piling, 12-ft. long.

GEORGE, HANKINS & GEORGE
Richmond, Va.

PILING

STEEL PILING BOUGHT AND SOLD

Please send us your specifications

UNIVERSAL EQUIPMENT CO.
Gluck Bldg., Niagara Falls, N. Y.

For Sale or Lease

HOISTS

Compressors—Boilers—Mixers
Derricks—Cableways

See list in issue of Feb. 12.

HOISTING ENGINE SALES COMPANY
Grand Central Sta., New York City

FOR SALE OR RENT

ROLLERS

2—Iroquois, 2½-ton Tandem Asphalt Rollers.
3—Pioneer, 5-ton, Tandem Asphalt Rollers.
2—Iroquois, 7-ton, Tandem Asphalt Rollers.
2—Buffalo-Pitts, 10-ton, 3-wheel road rollers.
1—Monarch, 3-wheel road roller.

CONCRETE MIXERS

2—1/3-yd. Ransome Mixers, direct connected to 10-hp. gasoline engine, mounted on trucks.
1—1/3-yd. Marsh-Capron, direct connected, 4½-hp. gasoline engine, mounted on trucks.
2—¾-yd. Ransome, direct connected to engine (steam).

HOISTING ENGINES

1—7¼ x 10 Mundy, D.C., D.D., Skeleton, equal to new.
1—6¼ x 10 Mundy, D.C., D.D., Skeleton, equal to new.
1—7 x 10 Mundy, D.C., D.D., with boiler, friction and link motion, drums side by side.
1—5½ x 10 National, D.C., D.D., with boiler.
4—Lidgerwood single friction drum hoists, belted or geared.

STEAM SHOVELS

1—No. 0 Thew ⅝-yd. dipper, traction full revolving shop No. 673.
1—65-ton, 2½-yd. Bucyrus, standard gauge.

PUMPS

1—Mather & Platt, centrifugal pump, 5½-in. suction, 5-in. discharge.
1—No. 5 Pulsometer, 3-in. suction, 3-in. discharge.
1—Size 12 Morris Centrifugal pump, 15-in. suction, 12-in. discharge, direct connected to 10-in. x 18-in. Morris Horizontal engine.

HORIZONTAL ENGINE

1—150-hp., 14-in. x 24-in., Porter-Allen engine, A1 condition.

MISCELLANEOUS

Vertical Boilers, 5 to 50-hp.
500 tons 70 lb. relaying rails with bars.
1000 pcs. 5-in. flanged C.I. pipe, 6-ft. lengths.
10 open tanks, 10-ft. x 15-ft. x 4-ft. 6-in. deep x ¼-in. metal.
750,000 lbs. Iroquois U. S. Standard Barbed Wire.
2,000,000-ft. resawed Long Leaf Yellow Pine planks and timber.
A very large stock of all size Second-Hand Pipe, from ¾-in. to 12-in. Smoke Stacks from 10-in. to 6-ft. diameter.
A large tonnage of boiler shells and tubes suitable for drains, etc.

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IMMEDIATE DELIVERY

1—10-ton **Industrial,** 4-wheeler, standard gauge, 36-ft. boom, immediate delivery. Not bucket handling. Price $6,000.
1—75-ft. boom, 10-ton Industrial **steel stiff-legged derrick,** motor driven from mast and boom, without motors. $2,500 f.o.b. our yard.
1—76-ft. boom, American Hoist wood **skid derrick,** similar to cut 805, page 119 American Hoist & Derrick Co. catalogue. $2000.
1—1½-yd. Class S. Page **Drag Line Bucket,** $650 f.o.b. our yard.
6—1½-yd. Koppel **Bottom Dump Buckets,** $100 each f.o.b. our yard.
2—No. 641 D.S. 1¾-yd. Lakewood Handler **Clam Shell Buckets,** A1 condition. $850 each f.o.b. our yard.
1—2-yd. Saurerman **scraper bucket** with blocks and shackles. $1,000.
2—Size 28, one-yd. Lakewood **concrete mixers** with steam engines and batch hoppers. $2,000 each, f.o.b. our yard.
1—One-yd. Smith **concrete mixer** with steam engine and batch hopper. $1,800 f.o.b. our yard.
1—15-Hp. **Port Huron Tractor,** $600 f.o.b. our yard.

THE DAY & MADDOCK CO.
Winslow Ave., N. W. & B. & O. R. R.
Bell Phone Main 422 Cleveland, Ohio

FOR SALE

1—10 x 12 D.C., 3-drum **Lidgerwood Hoisting Engine** complete with boiler and banked levers.

1—6 x 8 D.C. **Lidgerwood Swinging Engine.**

1—1½-yd. **Hayward Clam Shell Bucket.**

1—Type No. 0 Thew fully revolving traction **Steam Shovel** with ⅝-yd. dipper, combination boom, butt strap boiler.

2—6 x 8 Morris Steam direct connected **Centrifugal Pumps.**

Equipment Corporation of America
801 Empire Bldg., Pittsburgh, Pa.

CRANES

1—25-ton Ohio Locomotive Crane, 8-wheel, M.C.B., 50-ft. boom and 1½-yd. Hayward Clam Shell Bucket.
1—Model 3 Byers Auto Crane, road wheels, steam power, 30-ft. boom and ½-yd. Owen Clam Shell Bucket.

PAVERS

1—1/3-yd. Austin Paver, boom and bucket, caterpillar traction.
1—1/3-yd. Foote Paver, traction wheels, and chute.

ROLLERS

1—10-ton D.C., 3-wheel, Buffalo-Pitts.
1—5-ton Iroquois Tandem.

HOISTS

1—6½ x 10 D.C., D.D., Stroudsburg with boiler.
1—8-hp. single drum with elevator sheave, Byers Builders hoist with boiler.

MISCELLANEOUS

1—Type B **Emerson Jr. Pump.**
1—No. 3 **Emerson Pump.**
2—1-yd. **Ransome Controllable Buckets.**
1—1/3-yd. **Contractors' Tip Over Bucket.**
1—Lot Bits for E-24 **Ingersoll Rock Drills.**
1—Little **Jap. Hammer Drill.**

Your Inquiries Solicited.

EMPIRE ENGINEERING & EQUIPMENT COMPANY
311 Empire Building, Pittsburgh, Pa.

Locomotive crane, 8-wheel, 15-ton.
Thew O Type ⅝ **shovel.**
2—**Locomotives,** 4-ton, 24-in. gauge.
Bucyrus steam shovel, ½-yd. half circle.
Holt caterpillar tractor and trailers.
4—Maney scrapers, 1 yd.
Road grader, 10 ft. blade.
Austin 3 wheel roller.
Scarifier, 7,000 lbs.
Stiff-leg derrick, with 1-yd. clam.
Keisler clam shell, ⅝-yd.
30—V-shape **steel cars,** 1½-yd., 24-in. gauge.
Ingersoll-Sargent **compressor, 1,000 ft.**
25-kw., D.C. belted **generator.**
Centrifugal **4 x 5 pump with Erie engine.**
Sturtevant **Ring Roll Mill.**
Cleveland tractor, caterpillar.
Austin caterpillar mixer.
12,000 ft. **2-in. black pipe.**
Keystone excavator.

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BYERS AUTO CRANE

Traction wheels, perfect condition, and practically new. Immediate shipment.

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Arcade Bldg., St. Louis, Mo.

FOR SALE

FLORY HOIST

1—Double Drum Electric, with 75-hp., 220-volt, 3-phase, 60-cycle motor and controller attached.

FLORY ELECTRIC SWINGER

1—Independent, to suit above engine. Both variable speed motors.

Pittsburgh Machinery & Equipment Co.
Fulton Building, Pittsburgh, Pa.

DERRICKS

2—Stiff-leg, 14-in. 60-ft. booms.

HOISTING ENGINES

11—1, 2 and 3-drum, from 150-hp. to 8-hp. swingers.

ELECTRIC HOISTS

9—Single drum, 1 and 2 speeds.

CONCRETE MIXERS
(Steam and Gas)

8—Also complete line Badger Pavers; compact, light and durable.

STEAM PUMPS

10—Single, duplex and deepwell.

JOHN H. CARLIN MACHINE CO.
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For Prompt Shipment

1—8¼ x 10 3-Drum Lidgerwood **Skeleton Hoist.**
1—7¼ x 10 D.D., D.C. **Mundy Hoist and Boiler.**
1—4¾ x 6 D.C. **American Swinger.**
1—No. 3 **Dake Swinger.**
2—**Holding Drums.**
1—10-ton Kelly Gasoline **Roller.**
2—No. 30 Smith-Chicago **Mixers.**
1—¾-yd. **Smith Mixer,** all on skids. Sideloader. Steam Engine only. Can furnish Boilers.
1—Buckeye **Steam Trench Machine,** capacity 16-in. wide, 5-ft. 6-in. deep.

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Good Used Equipment — 50 CHURCH ST. **NEW YORK** — **Clean Business Methods**

HOISTING MACHINERY

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1—6¼ x 8 d.c., d.d., and boiler Lidgerwood.
1—10½ x 12 d.c., d.d. and swinger skeleton Lambert.

CRUSHER

1—7½ style K Gates Gyratory rear drive manganese fitted.

Quick Shipment

BYERS AUTO CRANE

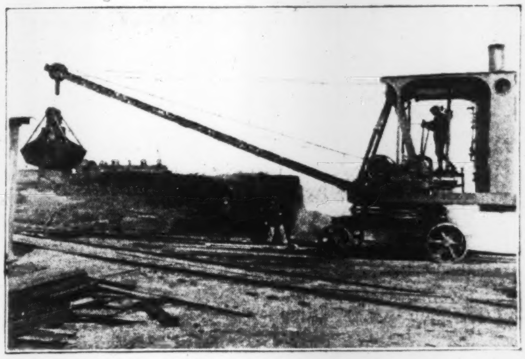
Late model, ¾-yd. clam. Located in Ohio.

36-in. gauge, Mogul type, 23-ton

LOCOMOTIVE

DANIEL B. STRALEY
Crown Point, Indiana

LOCOMOTIVE CRANES



Full Revolving Self-Propelling

Mounted on Traction Road Wheels Equipped with 30 ft. Boom and ¾ yd. Clamshell Bucket

ALL BRAND NEW

F. MAYER

37-8 Monadnock Bldg., Chicago, Ill.

LOCOMOTIVE CRANES

1—15-ton Industrial, Single Drum, 30-ft. Boom.

1—10-ton Wellman-Seaver-Morgan, Single Drum, 40-ft. Boom, 4 Wheel.

1—10-ton Industrial, Single Drum, 26-ft. Boom, 4 Wheel.

1— 8-ton Industrial, Single Drum, 30-ft. Boom, 4 Wheel.

BENDING ROLLS

1—18-ft. Wickes, one Top Roll of 17-in. and two Bottom Rolls of 12-in., direct connected, steam power.

1—15-ft. 8-in. Globe, 1 Top Roll of 16-in. and 2 Bottom Rolls of 12½-in., Motor Drive.

COMPRESSORS

1—Ingersoll-Rand Electric Driven, Capacity 880 ft., 100 lbs. air.

1—Chicago Pneumatic Steam Driven, Capacity 1,200 ft., 100 lbs. air

1—Rand, Double Stage Steam Driven, Capacity 1,400 ft., 100 lbs. air.

For Full Particulars Wire or Write

THE AMERICAN SHIP BUILDING CO.
Dept. D, Cleveland, Ohio

CABLEWAY

1—Lidgerwood 2-tower cableway, consisting of 1 75-ft. tower, 1 85-ft. tower, 34 sets of wheels with axles, carriage and carriers with four-part fall block and aerial dump attachment. Including slings and bridle for main cable. 900 ft. 2¼ in. lock wire cable with two sockets attached.

1—Lidgerwood special 12 x 12 cableway engine, shop No. 30093—4.

1—Button line. 1 Messenger line for electric signals.

AIR COMPRESSOR

21¼ x 13¼ x 18 Ingersoll-Rand, motor driven, capacity 1265 ft. per minute.

STONE CRUSHER

1—Gyratory No. 6-F with fittings.

Holbrook, Cabot & Rollins Corp.
52 Vanderbilt Ave., New York City

P. & H. Excavator Crane

FOR SALE—One No. 205, caterpillar traction; used six months only. Immediate delivery. $7,500 f.o.b. cars.

THE T. J. LANE EQUIPMENT CO.
Springfield, Ohio.

Osgood Combination Crane and Shovel

TYPE NO. 29

First-Class Working Condition

Crane, 40 ft.; boom ¾ yd.; Owen bucket shovel attachment. Used only 30 days.

25 ft. boom, 20 ft. dipper stick, ¾ cu. yd. dipper, maximum lift 23 ft. Price $10,500 F.O.B. Detroit.

IMMEDIATE DELIVERY

W. E. WOOD CO.
1805 Ford Bldg., Detroit, Mich.

Locomotive Crane

1—Used Model "D" "OHIO" Locomotive Crane, 20-ton capacity, eight wheel MCB, std. gage, equipped with double drums and 50 ft. boom.

Clamshell Buckets

1—Used Mead-Morrison 1½ cu. yd. cap. Bangup condition. New York City.

1—McMyler 1⅝ cu. yd. cap. Used one season in sand plant. Brooklyn, N. Y.

1—Used Lakewood ¾ cu. yd. cap. Excellent condition. Providence, R. I.

Titan Equipment Company
30 Church Street, New York, N. Y.

Heyl & Patterson Electric Crane

Third Rail System Gauge of track 17 feet. Hook 68 ft. above track. Clearance of 20 ft. for R. R. Cars under Crane Structure.

CAPACITY

5 net tons at 47½ ft. radius; 2.8 net tons at 75 ft. radius.

LIFTING SPEED

30 ft. per minute with 5-ton load; 100-ft. per minute with 2.8-ton load.

TRACK SPEED

120 ft. per minute.

REVOLVING SPEED

One revolution per minute.

Crane can be inspected and is ready for shipment at

Union Shipbuilding Company
Baltimore, Md.

CARS

Immediate Shipment

All in M.C.B. Condition

80,000 capacity **Gondola Cars.**
60,000 capacity Rebuilt **Flat Cars.**
60,000 capacity, 36-ft. **Box Cars.**
44-ft. cars suitable for **Bunk Cars.**

FOR RENT

60,000 capacity, 36-ft. **Box Cars.**
20-ton M.C.B. **Locomotive Crane.**

Asphalt Plants Locomotives
Locomotive Cranes
Road Rollers

Representatives:
Merriman Asphalt Plants

P. E. FRANCIS & CO.
Railroad and Industrial Equipment,
Marquette Bldg., Chicago, Illinois

STANDARD GAUGE LOCOMOTIVES

1—30-ton, four-driver, saddle-tank American.
1—40-ton, 17 x 24-in., four-wheel switcher.
2—50-ton, 18 x 24-in., six-wheel switchers.
2—18-ton, 10 x 16-in., 36-in. gage Vulcans.
2—14-ton, 9 x 14-in., 36-in. gage Vulcans.
2—10-ton, 7 x 12-in., 36-in. gage Vulcans.

MISCELLANEOUS

1—**Monighan Dragline**, 120-ft. boom, 3½-yd. bucket.
1—**Bucyrus Dragline**, 60-ft. boom, 2-yd. bucket.
13—16-yd. **Dump Cars.**
40—60,000-lb. capacity **Flat Cars.**
1—Western standard gage **Spreader.**
2—1-yd. Foote side-discharge **Concrete Mixers.**
50-lb. and 56-lb. Rail, Ties, 1½-yd. clamshell Bucket, and 10-hp. and 45-hp. upright Boilers. Railway Equipment, etc.

INDUSTRIAL EQUIPMENT CO.
McCormick Building, Chicago, Ill.

RELAYING RAILS

600 tons 60 lb.	400 tons 80 lb
700 tons 70 lb.	110 tons 90 lb.

NEW RAILS

150 tons 16 lb.	1200 tons 35 lb.
150 tons 25 lb.	1500 tons 40 lb.
200 tons 30 lb.	1100 tons 45 lb.

500 tons 85 lb.

Complete with All Accessories

THE MORRISON & RISMAN CO.

General Offices
Buffalo, N. Y.

703 Farmers Bank Bldg.
Pittsburgh, Pa.

FOR SALE

16—12-yard standard gauge two way

Western Wheeler Dump Cars

For further information write

H. C. WELLER COMPANY
Jacksonville, Fla.

For Sale and for Immediate Shipment

16—6-yd. K. & J. **Cars**, standard gage, two-way dumps.
12—36-in. gage **Western Dump Cars.**
2—36-in. gage **Davenport Locomotives.**
14—Standard gage **Box Cars.**
12—Standard gage 80,000-lb. capacity **Flat Cars.**
200-ton of 60-lb. **Relaying Steel**, good condition.
12—12-yd. Western **Dump Cars.**
1—Laidaw-Dunn-Gordon **Air Compressor**, 800 ft.
1—Overhead **Electric Crane.**
1—Standard gage **Tank Car**, 5,000 gal. capacity.
1—45-hp. Marine Type **Boiler**, complete with stack and all fittings.
1—30-hp. fire-box locomotive type **Boiler**, complete with all fittings and stack.
1—18-ton Galion **Unloader.**
1—Little Giant **Vulcan Steam Shovel.**
1—Automatic Thew full revolving **Steam Shovel**, excellent condition.
1—Erie B **Steam Shovel**, new. Never been used.

All equipment sold by us in first-class condition.

Write, wire or phone us for full specifications.

We are always in the market for good used equipment. Send us a list of your idle equipment.

CENTRAL MACHINERY & EQUIPMENT INSPECTION BUREAU
343 Spitzer Bldg., Toledo, Ohio

New RAILS Relaying

Prompt Shipments

L. A. Green Rail & Machinery Co.
Pittsburgh, Pa.

CARS

75—Standard gauge, 50,000 lb. capacity flat.
10—Cattle cars, metre gauge.
10—Box cars, metre gauge.
1—Standard gauge box car.
1—Standard gauge passenger coach.
4—Metre gauge passenger coaches.

HOISTING MACHINERY CO.
50 Church Street, New York

LOCOMOTIVES

Std. gauge, 14 x 20, Vulcan, 45-ton, 2-4-2.
Std. gauge, 20 x 24, Baldwin, 50-ton, 2-8-0, with tender.
36-in. gauge, Porter, 10 x 16, No. 3727.
36-in. gauge, Porter, 9 x 14, No. 1683.

DUMP CARS

25—Western and K. & J. 36-in. cars, 4-yd., 2-way.

GYRATORY CRUSHER

McCully, size No. 5, manganese head and concaves.

PAVING MIXER

Austin steam traction paver, power end loader, boom and bucket discharge.

STEAM ROLLERS

Tandem, Kelly-Springfields, 8-ton, 5-ton, 3-ton.
3-wheel Case roller, 10-ton.

GENERAL EQUIPMENT CO.
Drawer 45, Syracuse, N. Y.

RAILS

NEW—12 lb., 16 lb., 20 lb., 25 lb., 30 lb., 40 lb.
NEW—60 lb., 70 lb., 75 lb., 80 lb., 85 lb., 90 lb.
RELAYERS—30 lb., 35 lb., 40 lb., 45 lb., 56 lb., 60 lb.
RELAYERS—70 lb., 80 lb., 85 lb., 90 lb., 100 lb.
FASTENINGS—New Bolts, Nuts and Spikes.
New Frogs, Switches, Crossing, and All Accessories

Carload and less Carload. Rails cut to lengths for structural purposes.
Attractive Prices.
Immediate Shipments from Stock.

L. B. FOSTER COMPANY
Park Bldg., Pittsburgh, Pa.
Tribune Bldg., 154 Nassau St., New York, N. Y.

LOCOMOTIVES CARS LOCOMOTIVE CRANES STEAM SHOVELS

40-ton wooden hopper ballast cars, good for hauling gravel, cinders, ballast or coal; 28 ft. long, 5 ft. 3 in. high inside, capacity 1,375 cu. ft. Arch bar trucks, steel truck bolsters, steel channel spring planks, pressed steel bolsters, steel side stakes, Graham draft rigging, metal brake beams, Westinghouse A.B. Cars in fine condition.

American Railway Equipment Co.
Liberty Bldg., Philadelphia, Pa.

FOR SALE

LOCOMOTIVE

New American 40-ton saddle tank, 14 x 22, standard gauge, No. 60912.

Western Asphalt Paving Corporation
Odebolt, Iowa.

FOR SALE

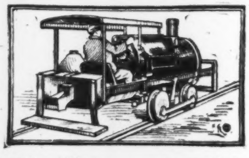
1—15 x 20, 4D, 43-ton **Vulcan S.T. Loco.**
1—16 x 24, 4D, 36-ton **Baldwin Switcher.**
1—9 x 14, 4D, 14½-ton **Porter 36-in. gauge.**
1—10 x 16, 4D, 18-ton **Porter 36-in. gauge.**
1—Type B, **Erie Traction Shovel,** ¾-yd.
1—Model 31, **Marion Traction Shovel.**
1—Model 31, **Marion, caterpillar traction.**
Dump Cars, Paving Mixers, Rollers, Derricks, Hoists, Buckets, Loco. Cranes, etc.

Everything for the Contractor

Send us your inquiries. We are reasonably sure to be able to serve you.

W. E. KENNEDY CO.
Union Bank Bldg., Pittsburgh, Pa.

FOR SALE
TWO BELL LOCOMOTIVES
7-TON-OIL BURNING



First-Class Condition Immediate Delivery
Full Specifications on Request

ENGEL & HEVENOR
220 BROADWAY, N. Y.

DUMP CARS

20—K. & J. Std. Gage 6-yd. 2-way.
3—Continental Std. gage 6-yd., 2-way.
Overhauled, new brasses, pins and links.
First-class condition.

J. T. WALSH
514 Brisbane Bldg., Buffalo, N. Y.

PORTABLE TRACK

5000 ft., 20-lb. section; 24-in. gauge; six ties per 15-ft. section; strictly first-class; some of it never used; immediate delivery.

Curves — Switches — Cars.

E. C. SHERWOOD
50 Church St., New York.

FOR SALE

9—12-yd. Standard Gauge **Western Dump Cars.**

1—Standard Gauge **Western Spreader Car.**

Above equipment may be seen operating in Cleveland

1—10-ton Kelly-Springfield **Road Roller.**

1—**Vulcan Shovel,** 3½-yd. dipper, 110 tons.

1—**Porter Trench Machine,** with 16 buckets, 300 ft. track.

1—Type "B," 20-ton, **McMyler-Interstate Crane,** new in 1919; located in Kansas City, Mo.

1—3-ton Plymouth **Gasoline Locomotive, 24-in.** gauge, shop No. 633; new 1919.

1—4-ton Cummings **Gasoline Locomotive, 24-in.** gauge, shop No. 828; new May, 1920.

1—Parsons **Trench Machine,** Type "E."

This equipment completely overhauled and in first-class condition. Can be inspected in my yard.

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HOISTING ENGINES

2—8¼ x 10 Lidgerwood, D.C., D.D., skeleton
1—7¼ x 10 Lidgerwood, D.C., D.D. skeleton
2—6-hp., 1—8-hp. Boss Gasoline Hoists.
1—Mead-Morrison Independent Swingers.

BUCKETS

1—Smith ½-yd. orange peel
4—½-yd. Contractors tip-over Buckets
10—1-yd. Contractors tip-over Buckets

STIFF-LEG DERRICKS

1—5-ton stiff-leg Derrick, 48-ft. boom
1—2-ton hand Derrick
1—Complete set of Lambert Stiff-Leg Derrick Fittings, 14 x 14 boom.
1—Set of Terry & Tench, 3-ton Travelling Derrick Fittings, with bull wheel and double flanged car wheels

PUMPS

1—No. 7 Pulsometer Pump, rebuilt
1—Each Nos. 4, 5 and 6 Pulsometer Pumps
1—No. 4 Emerson Steam Pump, complete.
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1—6-in. Morris Centrifugal Sand Pump.
1—4-in. Suction Nye Pump.
1—3-in. suction Nye Pump.

ROAD ROLLERS

2— 5-ton Tandem Iroquois
1—10-ton, 3-wheel Ohio gasoline Roller.

KOPPEL CARS

6—36-cu.ft. capacity, 30-in. gage, two way.
3—24-in. Rotary Dump Cars

CONCRETE MIXERS

2—½-yd. Smith, with steam power
1—½-yd. Lakewood on trucks with steam engine and batch measuring hopper
1—22-ft. Boss Mixer
2—8-ft. Boss Mixers, gasoline engine and barrow hoppers, on trucks
2—10-ft. Boss Concrete Mixers on trucks with gasoline engine
2—10-ft. Boss Mixers, gasoline engine, power loaders
1—15-ft. Boss Gasoline Engine and power load

STREET PAVING MIXERS

1—No. 5 A Foote concrete mixer with chute loader and steam power.

BOILERS

1—50-hp. Nagle Boiler, on wheels.
1—35-hp. O & S. Boiler, on wheels.

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Both Narrow and Standard Gauge, completely rebuilt

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1—Model 80-C Bucyrus, 4-yd. dipper.
3—Model 60 Marion.
3—Atlantic type, 2½ yd. dipper.
1—Bucyrus 45, 2-yd. dipper.
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DUMP CARS

of various types and capacities.

All in stock in Atlanta, Ga.

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36-INCH GAUGE DINKEY LOCOMOTIVE

18-ton, 10 x 16 in. PORTER Four Driver Saddle Tank, with steam brake. Thoroughly overhauled, including new tires. This is a good one, well worthy of consideration.

Price $3350, F.O.B. Chester, Pa.

We are strong on small locomotives and have over 25 within our call, various sizes and gauges.

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Ransome Concrete Mixers, Concrete Tower Equipment, Koppel Dump Cars, Air Compressors, Diaphragm Pumps, 2-in. and 3-in. Centrifugal Pumps, Wheelbarrows, etc.

All the above equipment in A-1 condition. Prices and information upon request.

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200—80,000 lbs. capacity, in M. C. B. condition, suitable for good roads construction.

Immediate shipment from Birmingham, Ala. Write or wire for specifications and prices

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36-in.; 11 x 16-in. four driver saddle tanks; steam brakes; insurance certicate 160 lbs. working pressure; butt strapped boilers.

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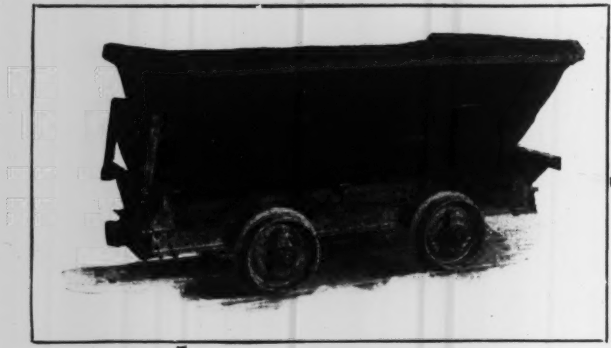


Dependable Dump Cars for Rough Usage

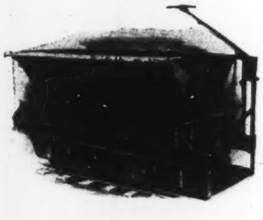
Every knock and bang sends the "average built" dump car nearer the scrap heap. Every bump brings you nearer added expense.

But you can work ATLAS dump cars to the limit. They are built to give maximum service and stand extraordinary wear and tear.

ATLAS DUMP CARS

are designed for every practical use and problem. And ATLAS engineers are always ready to scientifically solve your haulage problem and thus effect further economy and increase efficiency.

The ATLAS line consists of Trolley and Storage Battery type locomotives and cars for mine and industrial use, and all other kinds of haulage equipment.

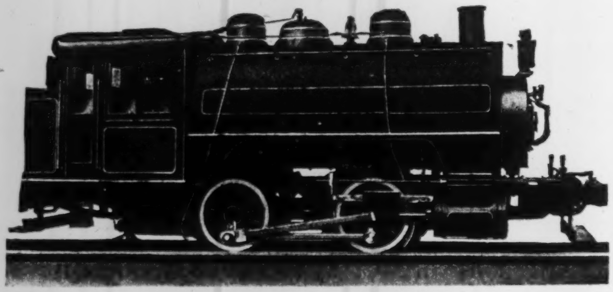


217 E. H.
This trolley type dump car pulls its own load.

The Atlas Car & Mfg. Co.

Engineers **Cleveland, O.** ***Manufacturers***

IMMEDIATE DELIVERY+SERVICE



13 in. x 20 in.— total weight 65,000 lb., tractive power 14,400 lb.
14 in. x 22 in.— total weight 79,000 lb., tractive power 17,400 lb.
16 in. x 24 in.— total weight 99,000 lb., tractive power 22,400 lb.

The American Locomotive Company has recently completed several 14 in. x 22 in. engines which are ready for immediate delivery. Our shops are now working on an order for 13 in. x 20 in., 14 in. x 22 in., and 16 in. x 24 in. engines which will be ready for delivery in May.

All the wearing parts of these engines are made to templates and gauges, and are absolutely interchangeable on the same size of engines. This method of construction allows us to keep these parts in stock, and assures immediate shipment of parts that are sure to fit.

Many hundreds of these locomotives are now in operation around industrial plants, mines, and in contractors' service. Repeat orders testify to the satisfaction given.

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A. Baldwin & Company, New Orleans, La.
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"Why Didn't the Architect Tell Me About Your Elevator?"

This is what the General Manager of a big concern putting up new plants said to Mr. Wm. H. Ridgway who had just been showing him the great points about the Ridgway Elevator.

The things we do not print.

And the General Manager was feeling very—well, I would not care to have a good customer feel toward me as that client felt toward his architect.

I know lots of you mill designers turn up your little noses at "Ridgway" and his "Hot Air" and "Old Hot Water Elevator."

But lots of you are getting left, and badly left, just because you are sound asleep—and Ridgway is wide awake.

We can tell you things Old Tee Square, that would make you set and take notice.

Why did you lose that last good job and it went to Lockwood, Greene & Co., C. B. Comstock, Monks & Johnson, Wm. Steele & Sons Co., Turner Construction Co., Austin Co., Albert Kahn, John J. Ferguson, Chas. T. Main, and many another of the Big Builders, all of whom are on to Ridgway Elevators?

Say, why not get sane for a minute? Where are you going to get off if you continue to ignore for the client with steam, the 3000 concerns of which these 21 are a sample?

United Gas Improvement Co.
Yale & Towne Mfg. Co.
Cluett, Peabody & Co.
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National Cash Register Co.
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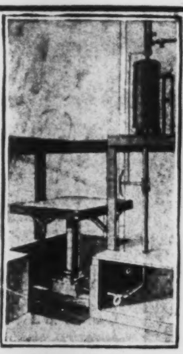
United States Government
E. I. Du Pont & Co.
General Electric Co.
Packard Motor Car Co.
Continental Can Co.
American Tobacco Co.
John Morrell & Co.

All of these are standing with Ridgway in the Market Place and also yelling

"HOOK 'ER TO THE BILER"

CRAIGE RIDGWAY & SON CO., **Coatesville, Pa.**
ELEVATOR MAKERS TO FOLKS WHO KNOW



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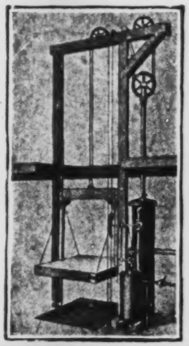
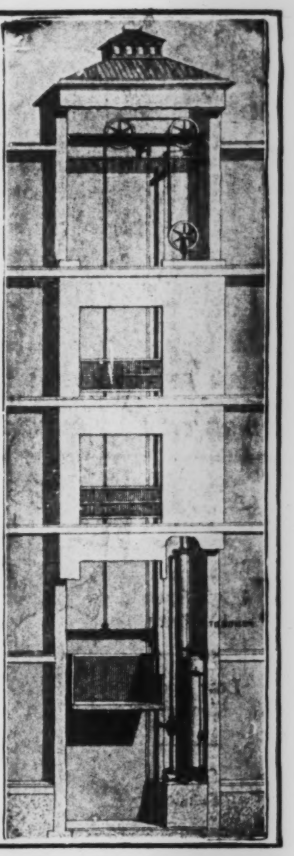
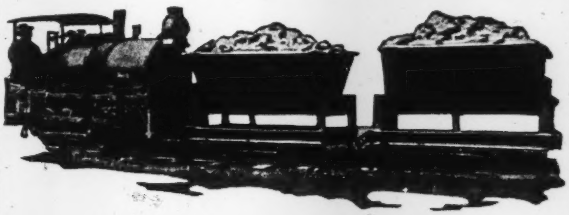




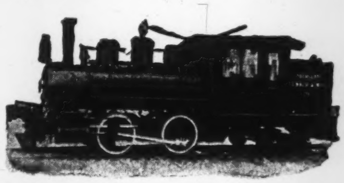


BELLS Cut Coal Costs

With the price of coal sky-rocketing and the outlook that soon none will be had at any price, you had better give serious thought to the fuel situation. Bell Locomotives burn kerosene.

Write for Details

Bell Locomotive Works, 23 Water St., N. Y. City



All sizes and types of light steam

LOCOMOTIVES

LOCOMOTIVE CRANES

Davenport Locomotive Works

Davenport, Iowa

Vitri-Flux
Is to Concrete What Tempering Is to Steel

As tempering develops desirable qualities in steel so VITRI-FLUX develops and improves the quality of concrete. It not only causes the cement to act quicker but more effectively. It is not merely an accelerator, the effect of which wears off and disappears in from one to three weeks; its action continues through the hardening period and leaves the concrete harder throughout its life.

In concrete floors VITRI-FLUX is a boon. It not only permits the quicker finishing of the floor, but renders it hard throughout, dustproof, wearproof and waterproof. A finished floor laid with VITRI-FLUX has a smooth, tile finish. A VITRI-FLUX floor is a SUPERIOR floor.

If you have any concrete work now in construction or in view, and if it is your desire to produce a super-concrete—an adamant concrete that resist hard wear as the Rock of Gibraltar resist the elements, USE VITRI-FLUX.

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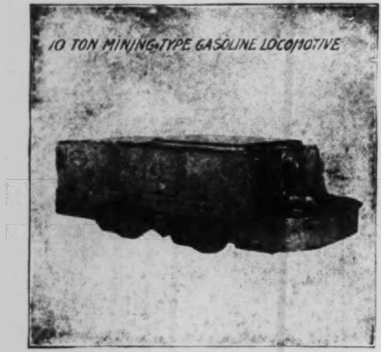

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IT WILL PAY YOU TO GET OUR PROPOSITION BEFORE YOU BUY

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5 TON STORAGE BATTERY LOCOMOTIVE

STORAGE BATTERY LOCOMOTIVES—1 TO 8 TONS ON DRIVE WHEELS

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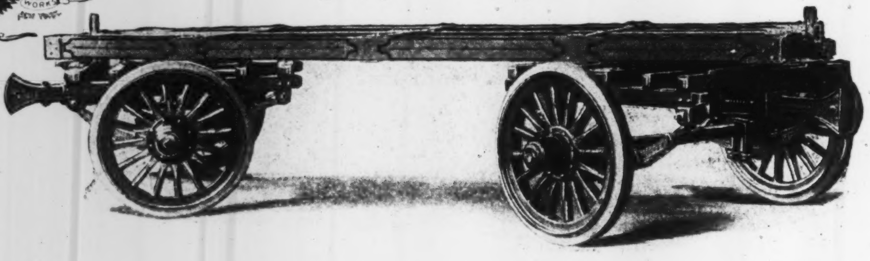
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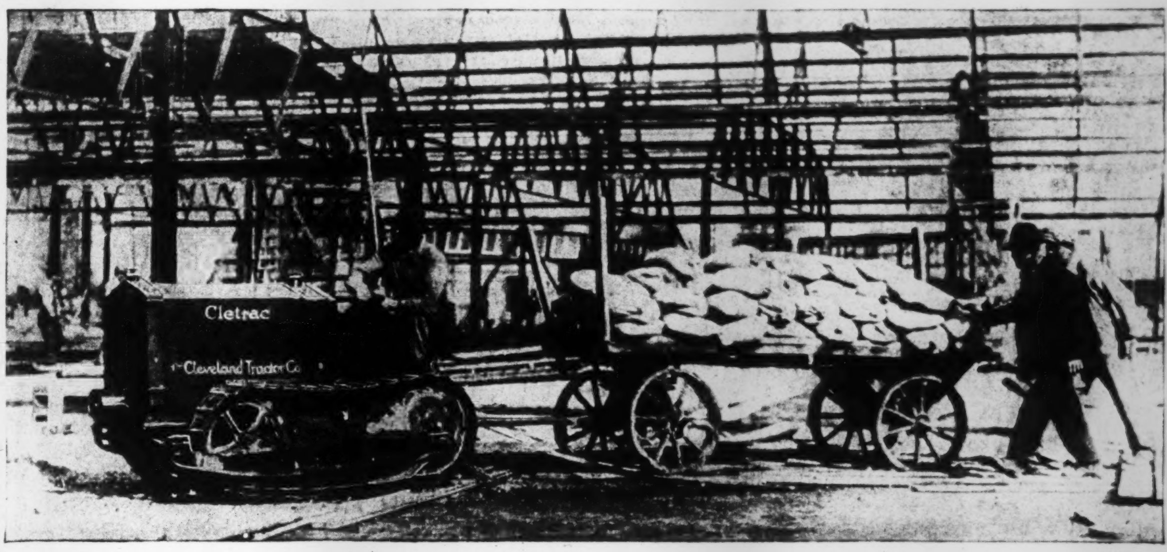
Baldwin Contractors' Locomotives

WALTER H. GAHAGAN
7

WE give the same careful attention to the building of light locomotives for Contractors' Service as to the heaviest class of motive power for trunk line railways. When you get a Baldwin Contractors' Locomotive, you get the best that can be produced in design, materials and workmanship.

You should have the 1920 Edition of our Record No. 86.

The Baldwin Locomotive Works
Philadelphia, Pa.



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TANK-TYPE TRACTOR

Wheels on a track — the Cletrac way — take less power

Put it up to the Cletrac

WHEN you need materials in a hurry and haulage conditions are bad—put it up to the Cletrac.

When there's road building and grading to be done—put it up to the Cletrac.

When you have a tough excavating job and men and teams are scarce and expensive—put it up to the Cletrac.

This sturdy little tank-type tractor goes anywhere and everywhere—runs on broad metal tracks over soft land or rough, stony ground.

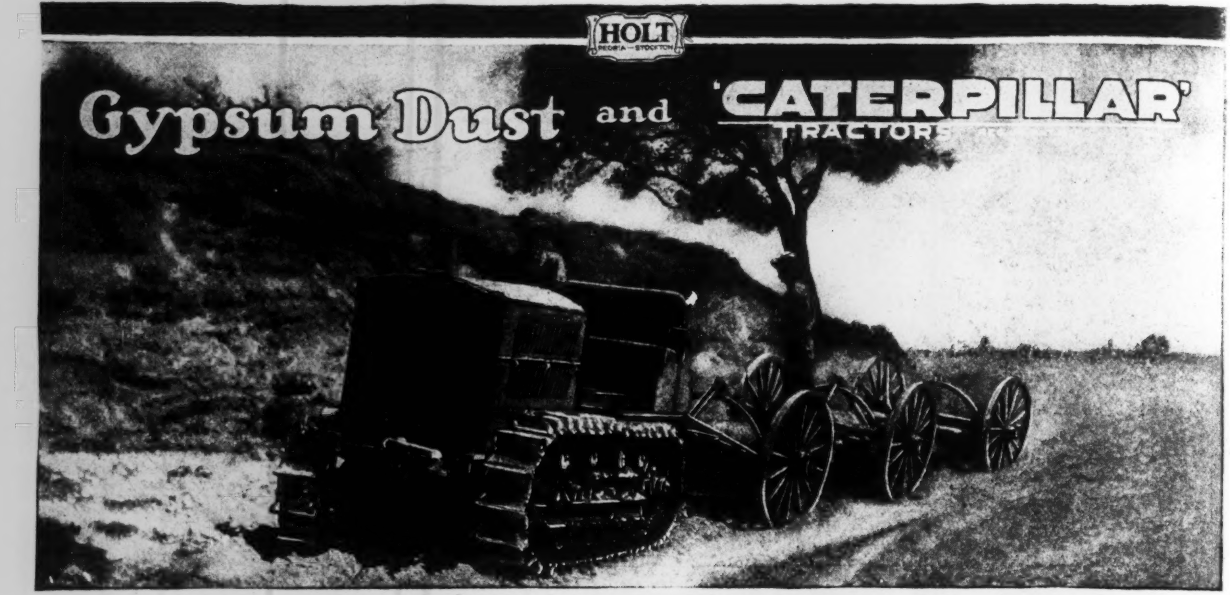
Contractors everywhere are enthusiastic about the tremendous work-capacity and low operating cost of the Cletrac.

Ask the Cletrac dealer or write us for further particulars on the use of a Cletrac in your work.

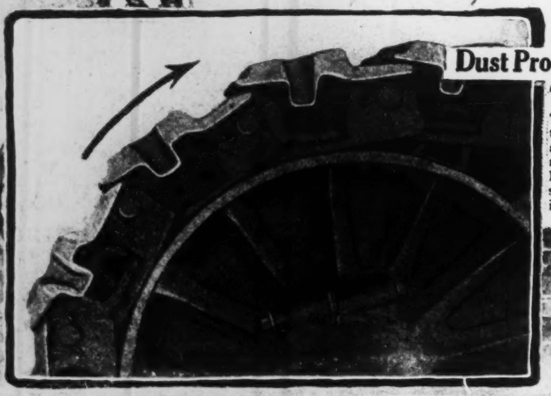
The Cleveland Tractor Co.

"Largest Producers of Tank-Type Tractors in the World"

19193 Euclid Avenue Cleveland, Ohio



GYPSUM dust eats the life out of machinery as quickly as emery. The American Cement Plaster Co. searched the market for a tractor that would stand this extreme punishment. *Holt was their choice.* Two 5-ton "Caterpillar" Tractors, running continuously in the abrasive dust of this gypsum pit at Agatite, Texas, are moving 400 tons daily.



Dust Proof, Mud Proof, Wear Proof Tracks

THERE is sound engineering back of every bit of "Caterpillar" Tractor Performance. Take the wear-defying durability of the "Holt-treated" steel track. Not only is this far stronger and tougher than Manganese steel or any other material that could be used — but it is also DUST, DIRT and MUD PROOF. The exclusive Holt ***overlapping track shoe*** is self-cleaning and keeps out the dirt.

CATERPILLAR
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HOLT
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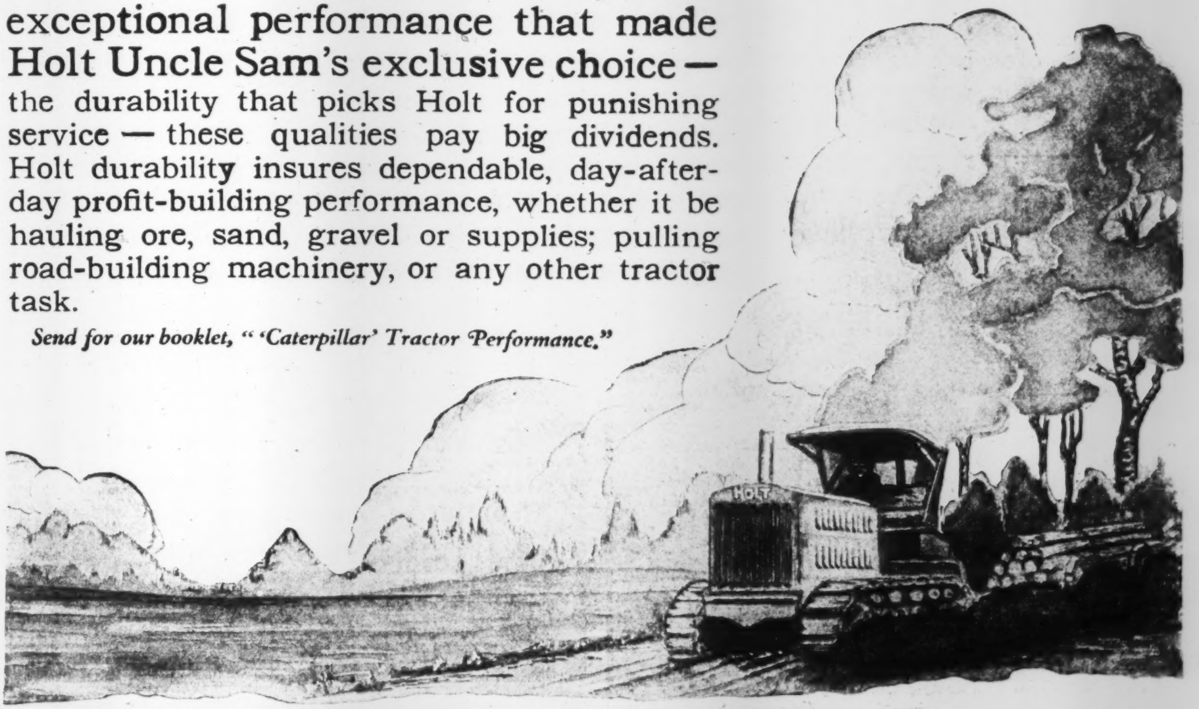
WHEN you own a "Caterpillar" Tractor, you command a portable railway system that goes anywhere at a moment's notice; that is operated by one man; that requires no tracks, ties, or right-of-way; that starts earning dividends for you the first hour you own it and keeps on piling them up 365 days every year.

THE contractor, mine-operator or road-builder, who buys a "Caterpillar" Tractor, secures both *Performance* and *Durability*. The exceptional performance that made Holt Uncle Sam's exclusive choice — the durability that picks Holt for punishing service — these qualities pay big dividends. Holt durability insures dependable, day-after-day profit-building performance, whether it be hauling ore, sand, gravel or supplies; pulling road-building machinery, or any other tractor task.

Send for our booklet, "'Caterpillar' Tractor Performance."



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COLD PATCH
ASPHALT
(Socony Brand)

For repairing all types of
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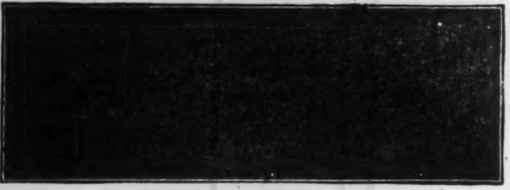

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Repair the surface—
you save the road

Ruts and small holes promptly repaired with Standard Cold Patch Asphalt mean lower maintenance costs now and fewer expensive operations later on.

Its permanency, spreading qualities and ease of application save time, labor and material. Workable the year round.

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for surface treatment.

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for penetration work.

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for brick or block pavements.

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EASTON CAR & CONSTRUCTION CO.
70

Scoop cars—to dump at both ends and also at both sides. *Ask for specification No. 4.* Whatever car suits your need best—we've made it for twenty-five years.

EASTON CAR & CONS'T'N. CO.

48 Church Street, New York Works: Easton, Pa.
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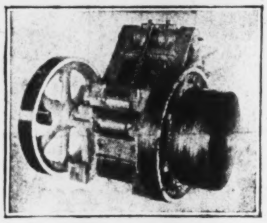

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Road Building
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Designed to give maximum service at a minimum cost for upkeep.

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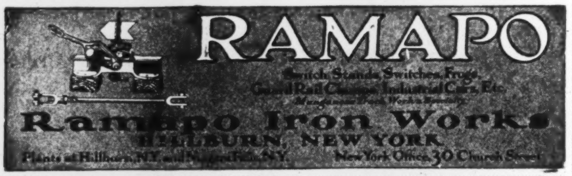

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Switch Stands, Switches, Frogs,
Guard Rail Clamps, Industrial Cars, Etc.
Manganese Track Work a Specialty
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Plants at Hillburn, N.Y. and Niagara Falls, N.Y. New York Office, 30 Church Street

Haul 1/3 More
Load your wagon with
Rapid Loaders
and keep the teams moving.
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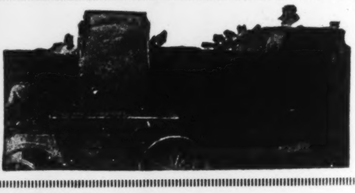
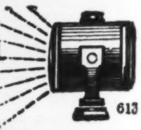


Compare Them



613

The faint light of a candle and the strong rays of a searchlight. They represent the comparative efficiency of other ways of finding what you want and advertising for it in the

SEARCHLIGHT SECTION

Employment Equipment Business Opportunities

Packard truck on road development. One of the advantages of a Packard as compared with the average truck on work such as this lies in its ability to deliver 86% of its engine power to the rear wheels on low gear—a greater per cent than any other make.

Why Packard Discarded "Ton Rating" for Packard Trucks

REASONING as *transportation engineers*, the Packard Company has believed for years that the arbitrary factory "ton rating" system was bound to become obsolete as soon as sufficient facts on transportation could be known.

These facts are now at hand — made available through more than 7000 Monthly National Standard Truck Cost System Reports covering a period of two years.

These reports confirm what Packard has so long foreseen —the fallacy of rating a truck simply on the tonnage capacity of the chassis and engine under normal conditions.

They have proved again and again the sound Packard practice of rating a truck with *all* the transportation factors in mind—character of roads, grades to be met, speeds to be maintained, and the chances of overload, etc.

Compare a Packard Size G, Model E, Truck, developing nearly 6700 pounds traction at rear wheels and able to pull a 28 per cent grade on low gear; with the typical "6-ton truck" of competing make, developing less than 4700 pounds traction, and able to pull only a 20 per cent grade!

The Packard frame both strong and flexible—made of rolled channel steel, not pressed steel.

Packard *solid tired* trucks governed at 11, 13, 15, 18 miles per hour by the Packard transportation expert in touch with the actual job.

Today, as always, Packard is selling *transportation*.

Hereafter each Packard truck will be designated by *size* and *model*.

The rating will be made on the ground, *for the job*, by the local Packard engineer—selected for what it will do in the individual customer's business, and with all his *actual conditions* in mind.

We have prepared an interesting booklet on motor hauling for the contractor. Sent by nearest Packard Distributor on request.

"Ask the Man Who Owns One"

PACKARD MOTOR CAR COMPANY, *Detroit*

TAXPAYERS' VALUE
BRICK ROADS

Good Night!

End of the brick road! That sinking feeling! Uncomfortable driving! Impossible hauling!

But of course your town lies the other way, and you see just the *beginning* of the "Taxpayers' Value" BRICK ROAD, the road of least cost per year of service.

Through national advertising we are telling your taxpayers what you already know—that even though ten years old this is only the *beginning* of the BRICK ROAD—for, properly constructed, it is good for decades more.

ROAD SIGNS. We are also prepared to furnish free, Detour, Street Closed, Road Closed signs, strong and serviceable. Write to nearest office for your supply, and for "Dependable Highways," a pavement classic.

NATIONAL PAVING BRICK MFRS. ASSOCIATION
802 ENGINEERS BUILDING, CLEVELAND, OHIO

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Southern Paving Brick Manufacturers Assn.
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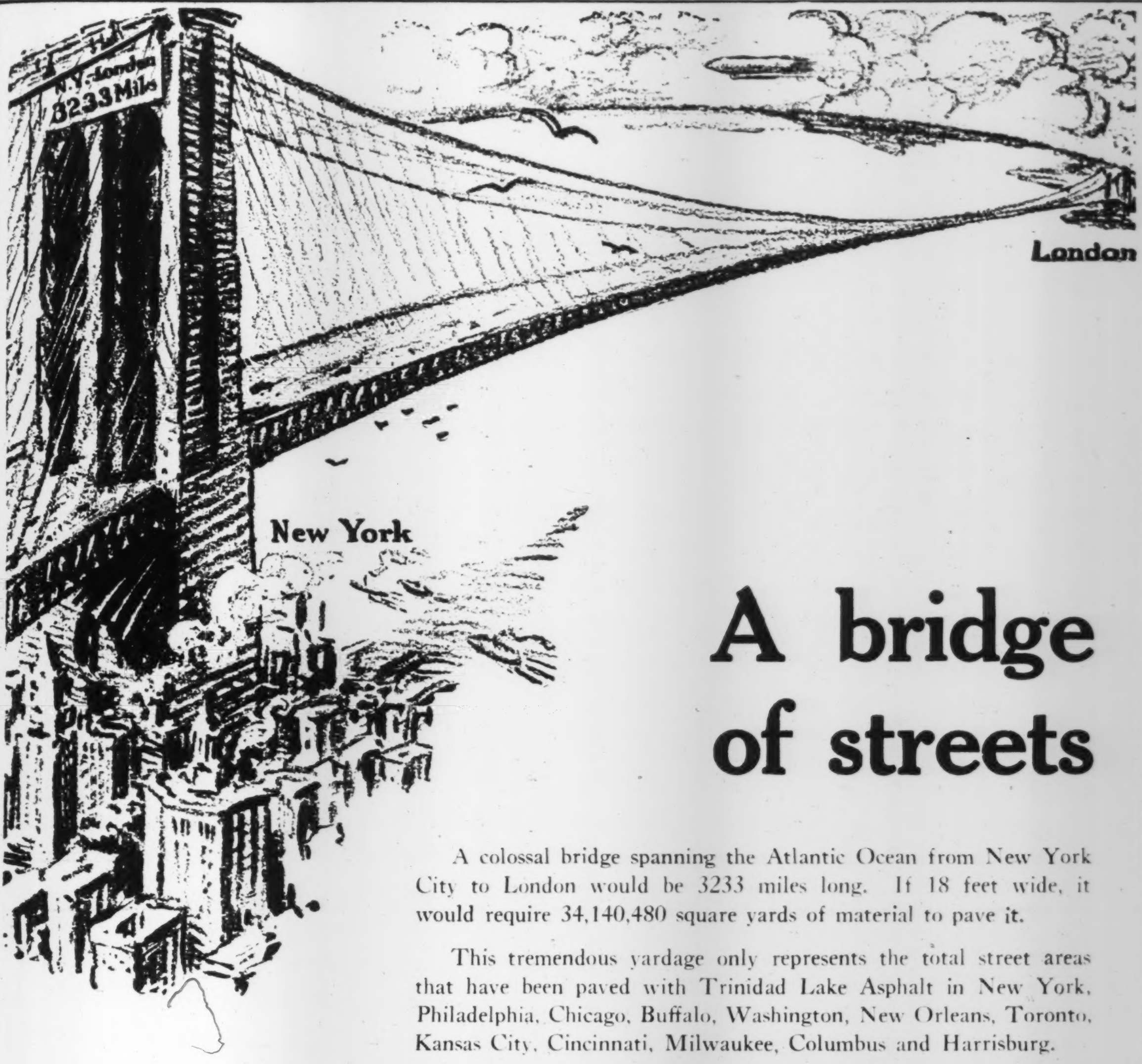
GUARANTY OF PAVING BRICK

Each member of the National Paving Brick Manufacturers' Association guarantees his product against defects in material and manufacture. Each brick in street or highway surface gives assurance of long and worthy service because each brick is a guaranteed service unit, complete and finished *before it is laid.*

or GOOD MORNING
Which way is your town moving?



A bridge of streets

A colossal bridge spanning the Atlantic Ocean from New York City to London would be 3233 miles long. If 18 feet wide, it would require 34,140,480 square yards of material to pave it.

This tremendous yardage only represents the total street areas that have been paved with Trinidad Lake Asphalt in New York, Philadelphia, Chicago, Buffalo, Washington, New Orleans, Toronto, Kansas City, Cincinnati, Milwaukee, Columbus and Harrisburg.

TRINIDAD LAKE ASPHALT

"Nature-Made and Nature-Tested"

is being used in vastly increasing amounts throughout the world. *It has been proved* that it will withstand the ravages of traffic and the elements longer and at *less maintenance cost* than any other bituminous material known. It is a native lake asphalt, seasoned for centuries.

Write for *"The Asphalt Time Table"*

The Barber Asphalt Paving Co.

Philadelphia

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TRINIDAD RECORDS

That No Other Bituminous Paving Material Can Equal.

BUFFALO, N. Y.

Bryant street paved with Trinidad Lake Asphalt in 1881. Now 39 years old and still in perfect condition. Maintenance cost only $0.03 per yard per year.

STANOLIND PAVING ASPHALT

Stanolind Paving Asphalt was used in building this splendid Asphalt-Macadam Road at Topeka, Kansas. Owing to its exceptional Bonding and Cementing Qualities, Stanolind Paving Asphalt is Durable and Economical.

STANDARD OIL COMPANY
(INDIANA)
CHICAGO, ILLINOIS.

When You Think of Steel Think of Carnegie

Since 1857 Carnegie Steel Company and its lineal predecessors have manufactured a larger variety of iron and steel sections than any other maker in the United States.

When you buy steel from this company it is backed by proved reputation, prestige and nearly three-quarters of a century of experience. Careful selection of material, technical skill and conscientious workmanship result in products of unusual merit. Control of manufacture from ore to finished product makes this possible.

"Carnegie" rolled on steel is a guarantee of quality, a guide post for wise buying.

Carnegie Steel Company
General Offices: Carnegie Building, Pittsburgh, Pa.

1363

The General Superintendent of a Northeastern Railway Prefers Armco Culverts

He states in a letter that they have numerous large and small Armco Culverts under the roadbed which have been in the ground from five to twelve years, and have given very good service indeed—all of them being in excellent condition today.

The illustration shows one of the larger culverts. It is five feet in diameter and has only a light fill to protect it from the heavy weight of passing trains. Armco Culverts of Rust-Resisting American Ingot Iron are the preferred culvert for railways and highways.

There is a manufacturer in nearly every state, and in Canada, making genuine rust-resisting **ARMCO CULVERTS** and other products of American Ingot Iron such as flumes, siphons, tanks, road signs, roofing, etc. Write for full information and nearest shipping point on products in which you are interested.

ARMCO CULVERT & FLUME MFRS. ASSN.
Transportation Bldg., Chicago

TRADE MARK
ARMCO
AMERICAN INGOT IRON
RESISTS RUST

FOR HIGH GRADE CLAY PRODUCTS

Sewer Pipe
Culvert Pipe
Wall Coping
Flue Lining
Stove Pipe

Our Standard Vitrified Sewer Pipe, Double Strength Culvert Pipe, Wall Coping and other Products will interest you.

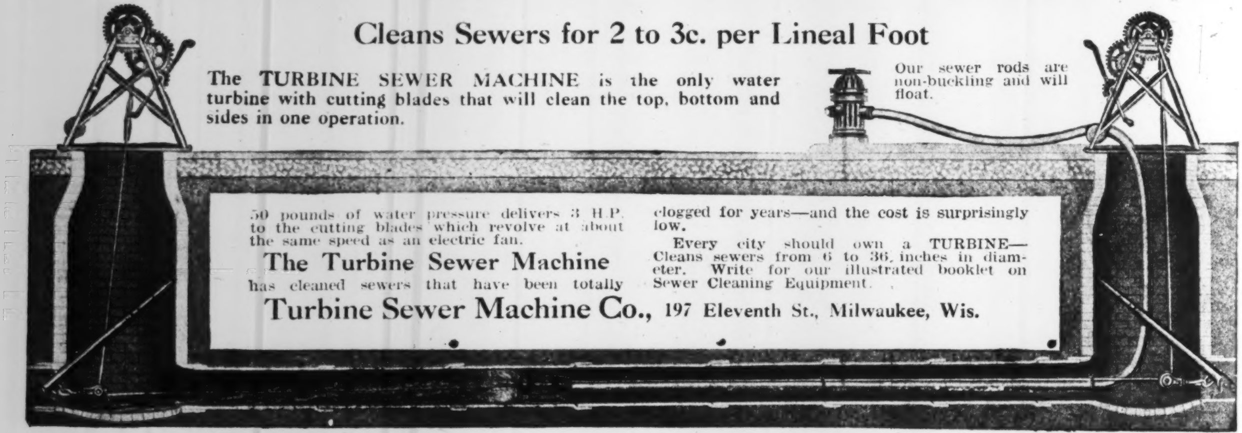
DEPENDABLE SERVICE

Write for full information and discounts

Chimney Tops
Paving Brick
Fire Clay
Drain Tile and
Kindred Products

THE DELAWARE CLAY PRODUCTS COMPANY

612 Arrott Bldg., Pittsburgh, Pa.



Cleans Sewers for 2 to 3c. per Lineal Foot

The TURBINE SEWER MACHINE is the only water turbine with cutting blades that will clean the top, bottom and sides in one operation.

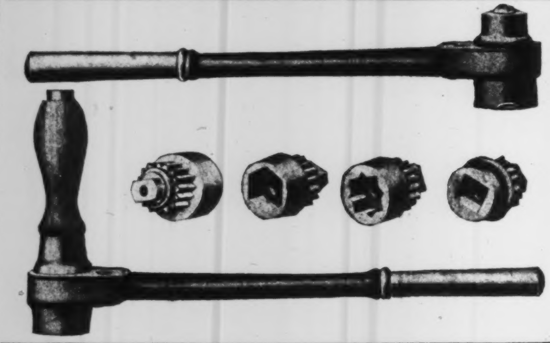
Our sewer rods are non-buckling and will float.

50 pounds of water pressure delivers 3 H.P. to the cutting blades which revolve at about the same speed as an electric fan.

The Turbine Sewer Machine has cleaned sewers that have been totally clogged for years—and the cost is surprisingly low.

Every city should own a TURBINE—Cleans sewers from 6 to 36 inches in diameter. Write for our illustrated booklet on Sewer Cleaning Equipment.

Turbine Sewer Machine Co., 197 Eleventh St., Milwaukee, Wis.



NOTHING TO DO BUT TURN

The *Lowell Reversible Ratchet* Wrench grips the nut like a vise and never leaves off till YOU are ready to do so.

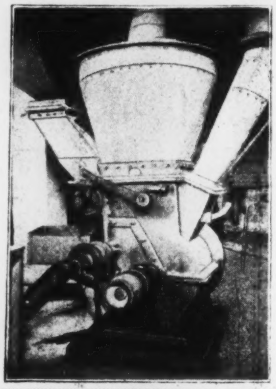
Think of the value it offers on account of its ratchet feature—on stuctural steel and bridge work—or in close quarters in general.

It is made to turn the nut or bolt safely, and surely— and it does it well.

Send for catalog R which gives the full story of the Lowell Reversible Ratchet Wrench—to-day

Lowell Wrench Co.

Worcester, Mass.



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equipped with

Air-Separation

for grinding all material to a powder.

If you have a grinding proposition ask us for full information today.

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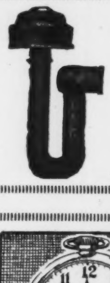
1302 N. Branch Street, Chicago



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Flushing Sewers and Disposal Plants.

Free Illustrated Catalogs

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Chicago, Ill., and New York.

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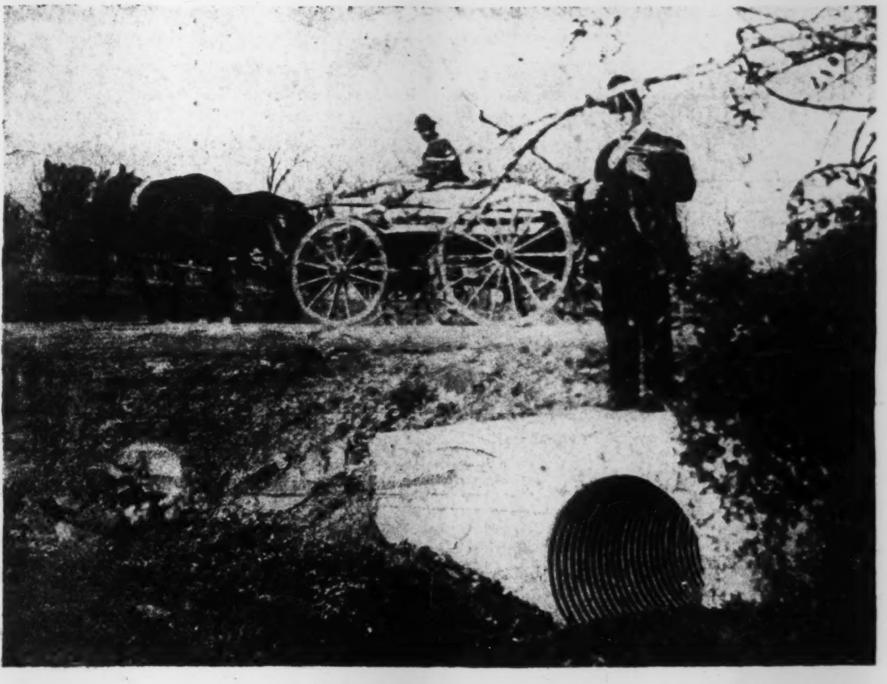
ONE-MAN
COLLAPSIBLE
CULVERT FRAME

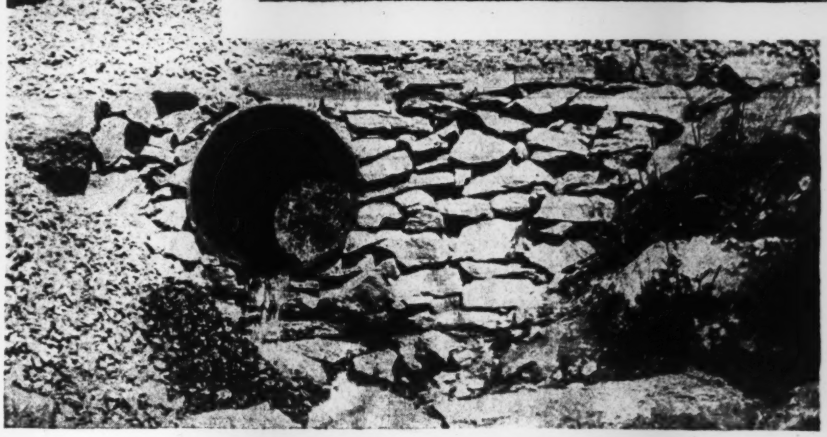
Save Time Building Culverts

Save the time it takes to build lumber culvert bracing—and save the lumber, too. Send for folder, "Experience Speaks," showing how contractors and highway officials are doing it. Write TODAY.

Storms Mfg. Co., Crawfordsville, Ind

NEWPORT CULVERTS *will not Rust!*





we repeat it *—they will not RUST—*

Because they are

Genuine Open Hearth Iron

99.875% PURE
Iron-Copper Alloy

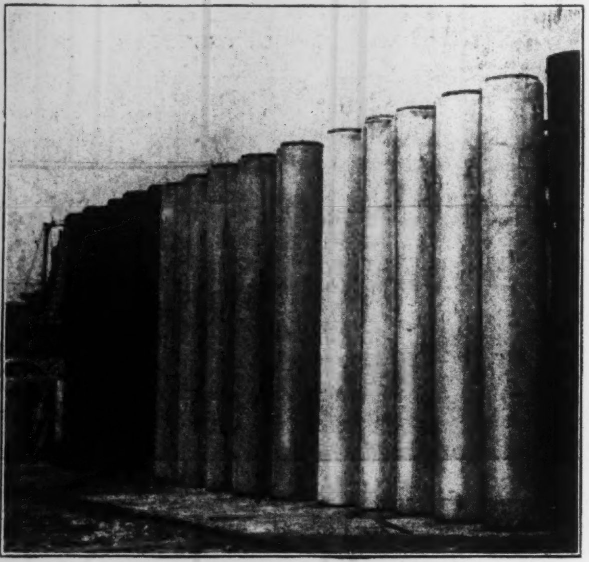
They contain not less than 0.25% copper and 2 oz. of spelter to every foot of exposed surface. That means *you can leave them exposed*—to weather of all kinds and varieties—and the years will pass by—but the Culvert *will not rust.* The metal will remain full strength and efficient and your investment will not depreciate in value.

Quickly and cheaply laid—possessing strength and lasting qualities. Newport Culverts are being used more and more every day by engineers all over the country.

Get the full particulars—in our handsomely illustrated catalog today

THE NEWPORT CULVERT CO
GENUINE OPEN HEARTH IRON
INC.
NEWPORT 641 W. 10TH ST. KENTUCKY

Reinforced Concrete Water Pipe



Our water line installations with copper or lead expansion joints in each section of Lock Joint Reinforced Concrete Pipe, have become recognized among leading engineers as dependable and durable.

THERE IS NONE SO GOOD

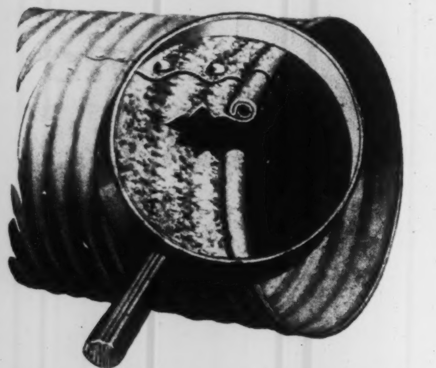
Bad trench conditions are no great handicap when you are laying Lock Joint Reinforced Concrete Pressure Pipe. When a 12 foot length of pipe is placed in position there is nothing to do but fill in back of it. You have added that much to your water line.

Standard sewer and culvert pipe, 12 to 48 inches always in stock for immediate shipment.

Lock Joint Pipe Company
1123 Broadway, New York

Manufacturing Plants, Ampere, N. J.,
Owego, N. Y.

Branches in Denver, Kansas City, Salt Lake City, Seattle and Winnipeg.



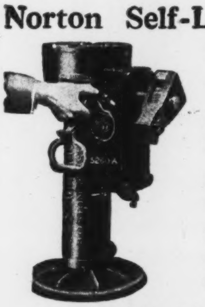
IMPERIAL Riveted SPC TONCAN METAL Corrugated CULVERTS

This End Reinforcement (Pat. applied for) is furnished with "IMPERIALS" of 24 inch in diameter or under, when specified.

It adds greatly to the strength of the culvert end and besides, it gives the culvert a nicely finished appearance.

THE CANTON CULVERT & SILO CO.
MANUFACTURERS
CANTON, OHIO, U. S. A.

Norton Self-Lowering Jacks Are the Fastest Jacks Made



They lower the full load with absolute safety by pressing the button—you do not have to pump or crank them down as with other jacks.

25 to 100 tons capacity—Plain and with foot lift. Send for complete illustrated Catalog No. 30.

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440 Brookline Ave., Boston, Mass.

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American Cement Tile Roofing

is being used wherever durability and ultimate economy are considered.
We can satisfy your roofing requirements.

AMERICAN CEMENT TILE MFG. CO., Oliver Bldg., Pittsburgh, Pa.
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THE SCOOP CONVEYOR

OVER 2000 USERS

FOR STORING AND RECLAIMING, LOADING AND UNLOADING CARS, TRUCKS AND WAGONS
DOES THE WORK OF FROM 6 TO 12 MEN AND KEEPS EQUIPMENT MOVING
WRITE FOR LITERATURE

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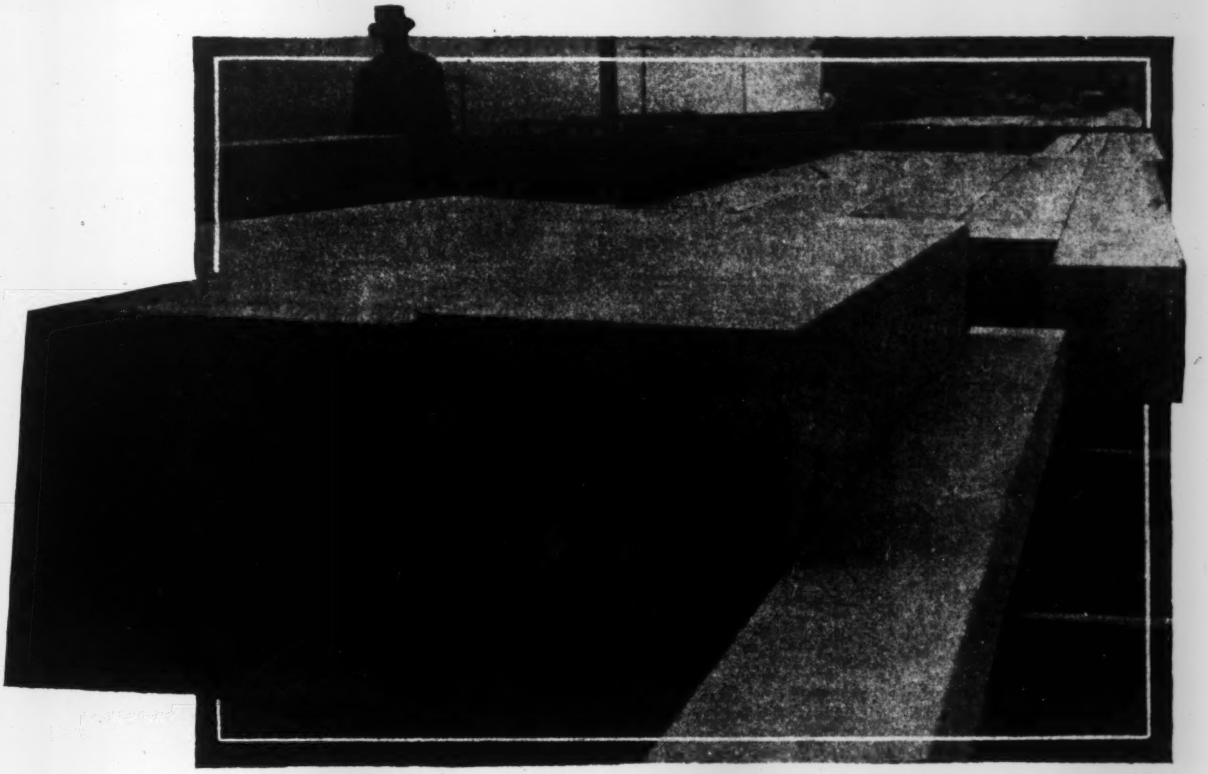

GUARANTEED *Long Leaf* PINE

HERE is more than ample proof that there is strength and durability behind that Calcasieu brand. It doesn't take an expert to see what sort of timber these sticks are, yet they were "shot at random" in our yards. Note the close annual rings, the liberal quantity of resin and, still more important, that trademark. The latter identifies only

It Meets
Highest
Specifications

CALCASIEU *Long Leaf* TIMBERS

manufactured and guaranteed. Acquaint yourself now with the products of our three mills; what the Calcasieu brand means to users of good timber. It is graded to meet standard specifications for strength and durability—not resistance. Insist upon that brand in your structural material and you can't go wrong. One stick is as good as another.

This Brand On Every Stick

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CALCASIEU LONG LEAF PINE
TRADE MARK
ROT RESISTANCE

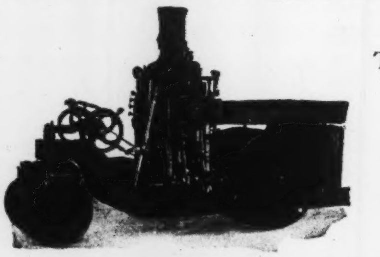
INDUSTRIAL LUMBER CO
Elizabeth, La.
Member Southern Pine Association

ROCKPORT

For docks, bridges, piers, foundations and paving blocks, granite is the ideal material. Quarried in monoliths of any size. Tidewater shipping facilities.

ROCKPORT GRANITE CO.
Rockport, Mass.

GRANITE



"ERIE"
Tandem Steam
Rollers
for

Strength
Durability
Simplicity

and

Economy of **Operation** and **Long Life**

Ask for Catalogue "N"

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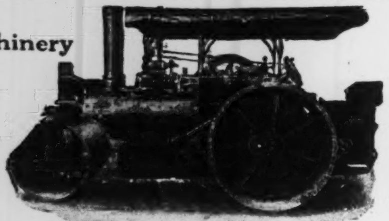
Erie, Penna., U. S. A.



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Buffalo Pitts Rollers

Are purchased by discriminating buyers because of the many years of satisfactory service which they will render, the low repair costs and their general reliability. *All sizes—all types—write for catalogue.*

Built Only by
THE BUFFALO-SPRINGFIELD ROLLER COMPANY
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PAVING BLOCKS

NEVER BUCKLE OR DECAY

We have been in the creosoting business 30 years and not a single piece of wood treated by us has ever decayed. **We manufacture Creosoted:**—Conduit, for underground wires, Poles, Ties, Cross Arms, Anchor Blocks, Posts, Piles, Plank, Lumber, Wharf and Bridge Timbers, etc. Also Wood Pipe and Steam Pipe Casings. Send for Catalogue C.

Wyckoff Pipe & Creosoting Co., Inc.
Established 1881
Creosoting Works and Factory: Portsmouth, Va.
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Has Made Good

LETTENEY
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WOOD PRESERVATIVE

For 53 Years

Complies completely with Standard Specifications for Carbolineum and Similar Wood Preserving Oils.

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Creosoted cross arms, Lumber, Paving Blocks, Piles, Poles and Ties. Private free wharf for ocean vessels at New Orleans. Capacity 100 million feet board measure annually.

Plants at New Orleans, La., and Louisville, Miss.

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Stock Sizes

Stop Crack Tie Hooks

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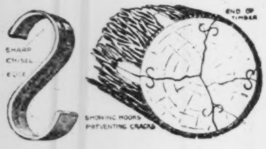

CARBOLINEUM
Wood Preserving Co. 35 Greene St. New York, N. Y.

Sole Producers of Protexol (formerly Avenarius Carbolineum) and other preservatives standardized for brush, spray or open tank treatments. Specifications drawn and cost estimates prepared on receipt of timber schedules. Quick shipments.

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CARBOLINEUM

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For brush, spray and open tank treatment

S. P. F. Wood Preserving Co., Inc.
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Established 1837

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LATEST DESIGNS Orders filled day received
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Special apparatus built to order

CREOSOTED { **WOOD BLOCK FLOORS**
WOOD BLOCK PAVING
CROSSTIES
TIMBER

THE OHIO WOOD PRESERVING CO.
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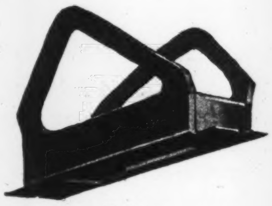
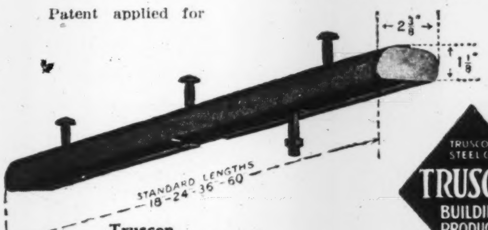


Truscon
Adjustable Insert

Truscon
Tapped Insert

Patent applied for



Truscon
Pressed Steel
Slotted Insert

Truscon Inserts

for attaching shaft hangers, fixtures, etc., in concrete buildings, eliminate expensive drilling into concrete. Their adjustability allows location of shafting and fixtures to be changed as desired.

Truscon Adjustable Inserts and Truscon Tapped Inserts are made of pressed steel, to carry ½-in., ⅝-in. and ¾-in. bolts. Truscon Slotted Inserts are made to carry ⅝-in. or ¾-in. bolts.

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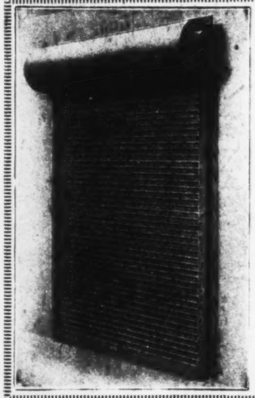
Truscon Steel Co.
(Formerly Trussed Concrete Steel Co.)
Youngstown, Ohio
Warehouses and Representatives in Principal Cities

TRUSCON STEEL CO
TRUSCON
BUILDING PRODUCTS



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Rolling and Bifolding Doors of Steel and Wood

Automatic Steel Rolling Fire Doors are labeled by the Underwriters' Laboratories Inc. They are positive acting—fire retardant.

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For all kinds of concrete forms. Speedy, simple, economical, secure. Low in first cost. Indestructible. Six sizes. Write for free sample and prices.

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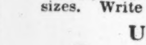

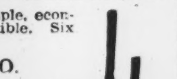

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Improved
For All
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DRYERS
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Great Capacity
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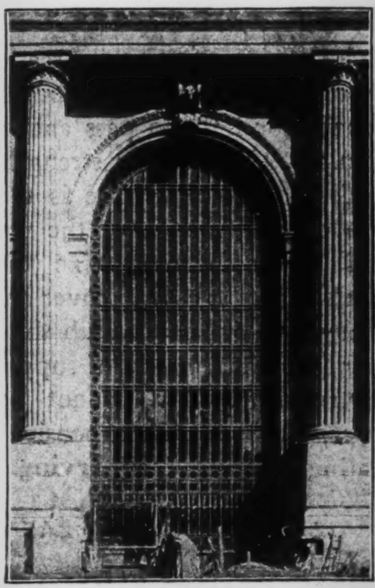
FIRE RETARDANT No. 32



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New York City
Reed & Stem, Warren & Wetmore, Associated Architects

A magnificent panel
of Polished Wire Glass

Mississippi Wire Glass Co.
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IRVING SUBWAY (PATENTED) TRADE MARK
THE FIREPROOF VENTILATING FLOORING

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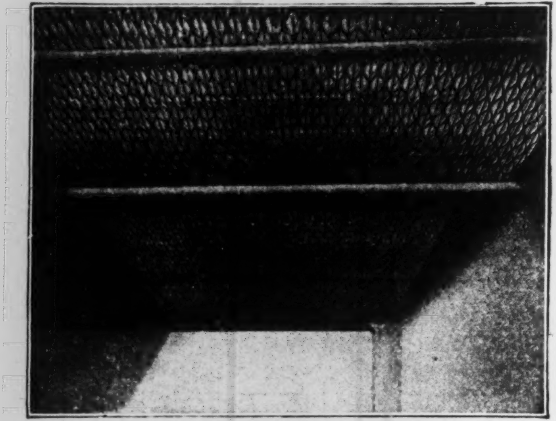

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Light and Air In Plenty

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ABSOLUTELY NON-SLIPPING ALWAYS

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LAPIDOLITH
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prevents concrete dust by making old or new concrete floors wear-proof.

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L. SONNEBORN SONS, Inc.
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Endurance Paint

PROTEXCIDE
TRI- CHROME PAINT

"LET US BE YOUR PAINT MAKERS" 1847 T THOMPSON & CO. PITTSBURGH, PA.

Its strong tensile film saves metal surfaces and inhibits rust. The value of Pro-Tex-Cide is proven where used.

Our engineering service is described in "The Paint Pilot," sent free

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TRADE **MINWAX** MARK

Waterproofing Materials and Protective Products
Write for Bulletins 21, 22, 23, 24
Minwax Company, Inc., 18 East 41st., New York

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Insure safety even with vibrating loads because nut cannot shift and strain is up in the concrete; take standard steel nut and provide sufficient play for adjustment of bolt.

Immediate shipments. Write or wire for prices.

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FOR PROMPT SHIPMENT

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ENGINEERING

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Damp-proofing the Broadmoor Hotel

was a job that called for the *best results* in this high-class structure catering to a rich and exacting clientele. The builders used

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DAMP-RESISTING PAINT

on the interior of outside walls above grade level. The plaster in walls so treated will be permanently damp-proof, stain-proof and vermin-proof. This black, waterproof tacky material makes furring and lathing unnecessary. It bonds perfectly and its results are demonstrated in jobs all over the world.

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STEEL NEED NOT RUST!
WOOD NEED NOT ROT!
NOR CONCRETE DUST!

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Franklin Steel Works
Franklin,
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No Matter How You Order

"Franklin"

Steel for Concrete Reinforcing

You get it as promptly as you need it. Service is one of the chief things that has made the quality of Franklin Steel popular. Prices are right, too. Ask for quotations.

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Complete, All-Steel, Permanent and Fireproof. Material stocked, ready for shipment. Erection with local labor. Wide variety of selection for such uses as:

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Complete Descriptive Catalogue on Request.

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Transmission Towers—Radio Towers—Steel Poles

Concrete Reinforcing

Steelcrete
TRADE MARK REGISTERED

For floors use flat sheet reinforcement. Stronger, more durable, greater economy. "Steelcrete" saves time, cuts costs.

THE CONSOLIDATED EXPANDED METAL COMPANIES
Braddock, Pa.
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COPPER STEEL
Galvanized
Sheets

Highest in quality and rust resistance. Unequaled for Culverts, Flumes, Tanks, Roofing, Siding, Spouting, and all exposed sheet metal work.

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We manufacture Sheet and Tin Mill Products of every description—Black and Galvanized Sheets, Corrugated and Formed Products, Roofing Tin Plates, Etc.

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SCREENS OF ALL KINDS
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ADJUSTABLE WIRE CLAMPS
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SAVE LABOR
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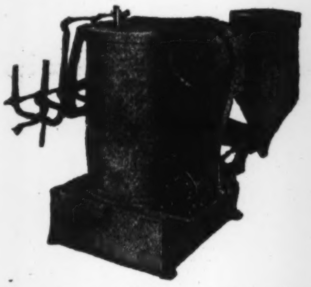
and Ship It Back to the Mill
In Returned Sacks?

As a result of using our *cement bag cleaner* in building one plant there was saved *one hundred and four tons of cement* and over *one hundred dollars* on freight in sending empty sacks back to the mill, besides the saving of labor.

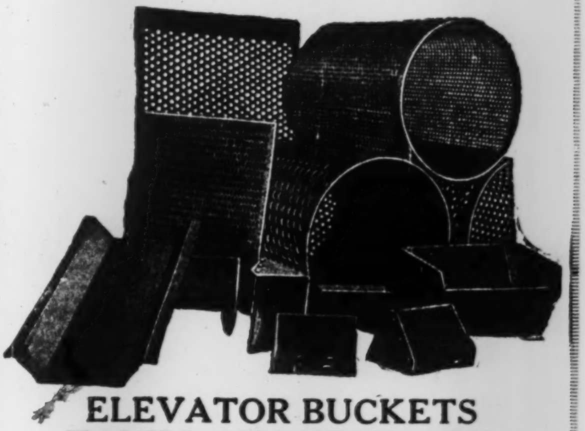
At no time has there been the need for saving there is at present, on account of the cost of material and the cost and scarcity of labor.



A descriptive circular giving further information will be mailed you upon request

Century Cement Machine Co.
Manufacturers of Concrete Block Machines
No. 60 Brown's Race, Rochester, N. Y.

Perforated Metal Screens
for
Stone, Gravel, Sand, Etc.



ELEVATOR BUCKETS
TANKS, SMOKESTACKS
Conveyor Trough and Flights
GENERAL SHEET AND
LIGHT STRUCTURAL WORK

Write for your copy of our Hand Book

Hendrick Manufacturing Co.
73 Dundaff Street, Carbondale, Penna.
New York Office: 30 Church Street

LIVING — STONE

CEMENT BOND

OUR TRADE MARK SINCE 1905

The Perfect Bond
for Concrete

Contains no acid. Therefore cannot injure concrete or steel. Forms a bond stronger than the concrete itself

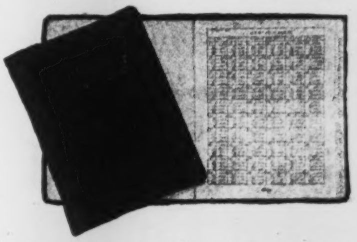
Catalog on request

THE LIVING-STONE CO.
227 Courtland St., Baltimore, Md

LACLEDE STEEL COMPANY
St. Louis, Mo.
CONCRETE REINFORCING BARS

Works:
Madison, Illinois
Alton, Illinois
East St. Louis, Ill.

General Offices:
1317 Arcade Building
St. Louis, Mo.
Chicago Office: 208 S. La Salle Street
Kansas City Office: 228 Scarritt Bldg.



HOGG'S
Wage Tables
FOR
Contractors
Pocket Edition
Full Leather Binding

The Amount Coming to each Man on the Payroll at a glance.

These tables are figured to every quarter hour from 30c. to $1.50 per hour, covering every rate and future rate in the Building Trades. Rates such as 56¼c. per hour, 68¾c. per hour, etc., are included. Thumb index to every rate.

SEND FOR DESCRIPTIVE LEAFLET.

J. O. HOGG, JR. & CO., 536-8 Rialto Bldg.

Live Agents Wanted **KANSAS CITY, MO.**

"ANTI-HYDRO" Makes Concrete Garage Floors Waterproof, Oilproof and Wearproof

These garage floors are a good example of how *thoroughly* and *permanently* "ANTI-HYDRO" hardens and waterproofs concrete. They are so absolutely waterproof they do not absorb a particle of water or oil. They are so hard they are unaffected by wear from chains and other severe conditions encountered in a garage.

"It is the easiest thing in the world to *permanently* harden and waterproof concrete with 'ANTI-HYDRO'. Just mix it with the gauging water. No extra work, no further application is necessary—and you save labor.

"Why experiment when 'ANTI-HYDRO' has so conclusively demonstrated its effectiveness over a period of sixteen years."

ANTI-HYDRO WATERPROOFING Co.
299 BROADWAY · · · · · · · · NEW YORK

THE AUSTIN CO., CONTRACTORS

GARAGE, ROESSLER & HASSLACHER CHEMICAL CO.

"The Railroads are our Partners. They are suffering from a lack of rolling stock and equipment. The Government must speedily help in order that industries may furnish necessary supplies so that food, clothing and shelter may be obtained at reasonable prices."

Vulcanite Portland Cement Co.

Main Office
Land Title Building
Philadelphia
Main Sales Office
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New England Office
161 Devonshire Street
Boston
Works Office
Post Office Address
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Business Established 1832

The Lawrence Cement Co.
No. 1 Broadway New York
Selling Agents for

Dragon
PORTLAND CEMENT

In Successful Use Nearly a Third-Century

Book on request showing uses and testimonials

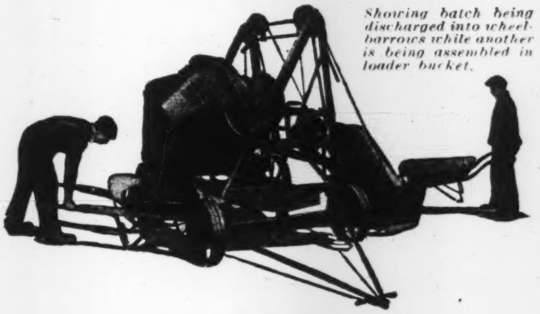
"Concrete for Permanence"

"The Indestructible Roof"
FOR FLAT and PITCHED SURFACES
Made, Laid and Guaranteed by
FEDERAL CEMENT TILE COMPANY
110 S. DEARBORN ST.
CHICAGO
HAMMOND, INDIANA — Works — DETROIT, MICHIGAN

DEXTER
for
Service and Quality

Dexter Portland Cement Co.
New York | Nazareth, Pa. | Phila.

The Jaeger Mixer

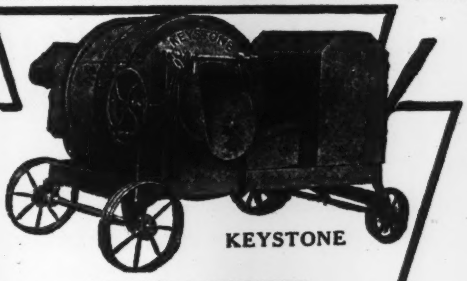


Showing batch being discharged into wheelbarrows while another is being assembled in loader bucket.

There's a GOOD reason for A MIX A MINUTE

The Jaeger Mixer with its tilted drum, interior surface formation and special arrangement of the blades gives a uniform and smooth concrete in the shortest possible time. That's why it speeds up the job and cuts cost—and jobs everywhere *prove* it.

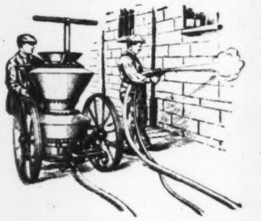
The Jaeger Machine Co.
200 W. Rich St., Columbus, Ohio



KEYSTONE

"A MIX A MINUTE"
means money for you. Structures are built to endure and contractors' reputations are made with concrete mixed in the KEYSTONE 10 cubic foot. MIXER. Write for circular.

Gray Iron Foundry Co.
READING. PA.



CEMENT-GUN
TRADE MARK

CONTRACTING
OPERATING
RENTING

TRAYLOR-DEWEY CONTR'G CO.
ALLENTOWN, PENNA.
Specialists in

GUNITE CONSTRUCTION

Write for Prices

OSHKOSH

Over-Powered

Every Oshkosh Concrete Mixer is constructed with more than enough power to efficiently handle the work for which it is designed. This over-supply of power protects the mixer from unnecessary strain and thus assures it of a longer life of service.

OSHKOSH Standard Mixer

is a glutton for work. Special arrangement of blades and buckets inside the drum, together with its five-motion mixing action, guarantees a very rapid, thorough mix. Built in sizes of 14, 21 and 28 cubic feet. Powered by electric motor, steam or gasoline engine.

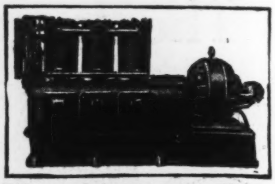
There is an Oshkosh mixer for every job. Made in capacities of 5, 7, 14, 21 and 28 cubic feet of mixed concrete.

Sales rooms and service stations in all principal cities. Write for catalog.

OSHKOSH MFG. CO.
830 So. Main St., Oshkosh, Wis.

New York Branch: 154 West 38th St., New York, N. Y.
R. H. Hyland & Co., 323 No. Wells St., Chicago, Ill.
Garfield & Co., Hearst Bldg., San Francisco, Cal.

Westinghouse--National air compressors are especially adapted to busy foundry work



3VS type of air compressor, direct-driven through gear and pinion. See Catalog No. 401.

Blowing loose sand out of moulds

Many delicate little jobs of foundry work, such as blowing out loose sand from the newly made moulds before pouring is done, can be performed better by air pressure. A little blast of air at this stage will frequently convert what might be a porous casting into a solid, perfect one. Protected compressors, especially adapted to foundry work is one of our specialties. Get our Catalogue No. 401.

Westinghouse Traction Brake Co.
General Offices and Works:
Wilmerding, Pa.

OFFICES:

Mexico City	New York, N. Y.
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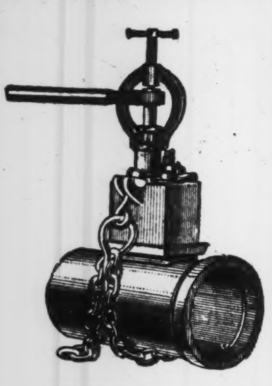
Houston, Tex.	St. Louis, Mo.
Los Angeles	Washington, D. C.

Easily Carried By One Man

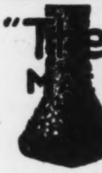
This light, durable machine will be sent on approval for 30 days' trial. If not as represented, send it back.



Corporation Tapping Machine

Write for latest bulletins of this and other water-works appliances.

The A. P. Smith Mfg. Co.
East Orange, N. J.



"The Pile With a BIG Foot"

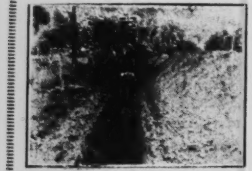
MacARTHUR PEDESTAL PILE-

The MacARTHUR METHOD insures maximum foundation safety under every working condition and in all kinds of soil.
Complete information on request.
MacArthur Concrete Pile & Foundation Co.,
12 John Street, New York City.

Smith, Hauser & MacIsaac, Inc.

CONTRACTORS
18 East 41st Street, New York, N. Y.

Aqueducts, Subways, Dams, Railroad Work, Docks and Piers, Shafts and Tunnels.



We Sub-Contract Trench Work

by lineal foot for Sewers, Water Mains, Gas Lines, Conduits and Street Railway Trenching.

General Engrg. & Const. Co.
608 Trust Bldg. - - Rockford, Ill.

Schramm Power Units

ENGINES
COMPRESSORS
PUMPS
HOISTS
MIXERS

CHRIS D. SCHRAMM AND SON, Inc.
MANUFACTURERS
Philadelphia—New York—Chicago

DIAMOND CORE DRILLING

Accuracy Since 1884 **Reliability**
Booklet 4122
SULLIVAN MACHINERY CO.
124 S. Michigan Ave., Chicago

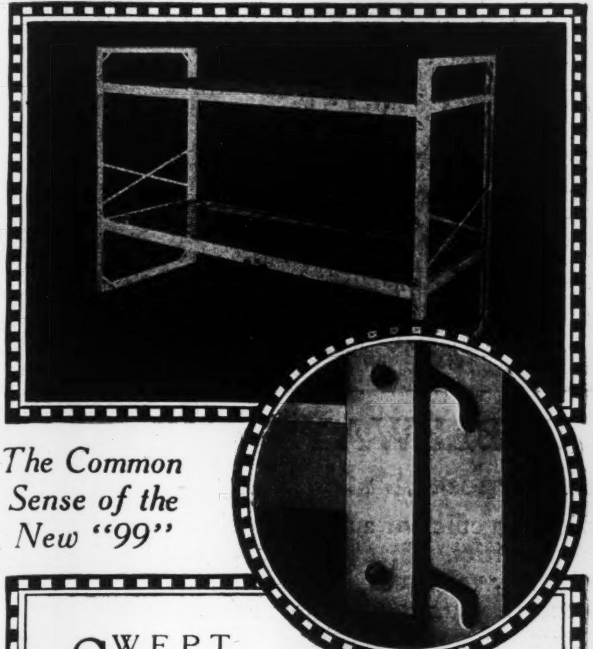
The Underpinning & Foundation Co.

290 Broadway, New York City

Difficult Foundations

Pneumatic, Steel, Concrete and Wooden Pile Foundations. Bridge Piers; Underpinning Heavy Buildings.

"HERCULES" STEEL PILES



The Common Sense of the New "99"

SWEPT the field last year. The new double locking button system of the Romelink "99" all-metal bunk does away with the supports and braces—the weakness of the old-style knock-down.

Give the most ignorant "huskie" the four pieces—he merely slides the spring frames into place and the whole bunk is immediately locked with absolute rigidity.

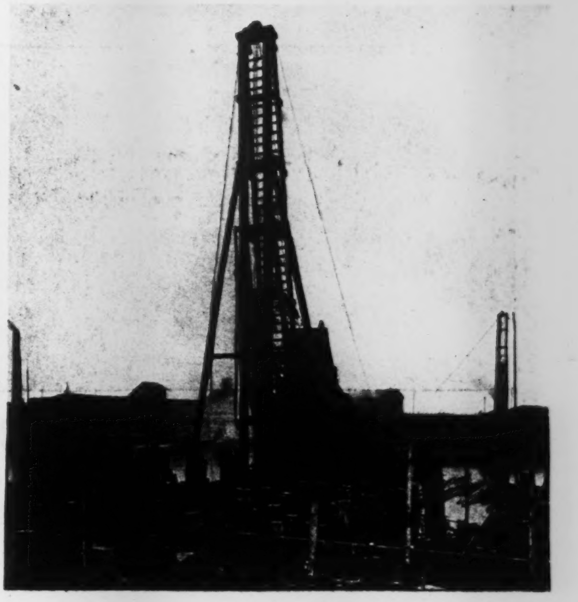
Nine husky men were crowded on a double-tier Romelink "99" at our shop. There was neither sag nor sidesway, just absolute rigidity.

Altogether, it's the strongest, most comfortable and most economical bunk system for railroads and contractors.

Send for detailed information on this new Romelink product.

Southern-Rome Co.
Branch of
Rome Metallic Bedstead Company
633 W. Pratt St., Baltimore, Md.

ROME LINK "99"



Brief Facts for Busy Workers—No. 5

Always in Stock
Ready for Immediate Shipment

McKiernan-Terry
9B and 11B
PILE HAMMERS

For the heaviest wood, concrete and sheet steel piles. Write for Bulletin 25.

McKIERNAN-TERRY DRILL COMPANY

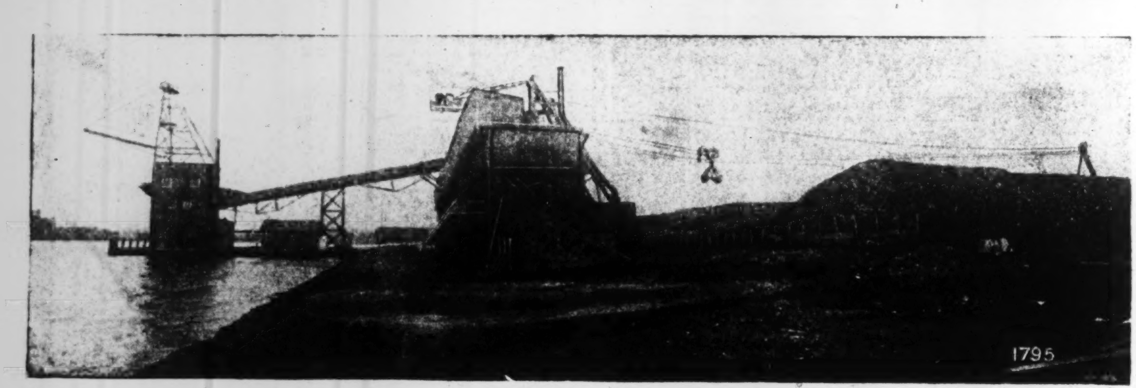
Rock Drills—Pile Hammers—Lifting Jacks—Mining and Quarrying Machinery

13 PARK ROW, NEW YORK
Works at Dover, N. J.

Foreign Representatives: **British Steel Piling Co., London, Eng.**
Canadian Representatives: **Canadian Allis-Chalmers, Ltd., Toronto, Ont.**

Agencies in following cities:

Boston
Chicago
Philadelphia
Cleveland
Columbus
Detroit
Pittsburgh
New Orleans
San Francisco
St. Paul



LIDGERWOOD CABLEWAYS

For Industrial Purposes

The Lidgerwood Traveling Cableway provides an efficient and economical means for handling coal, sand and gravel, etc., in large quantities. Plant illustrated handled 130 tons per hour from barge to hopper. The cableway takes coal from hopper to storage pile and reclaims from pile to hopper. Send us your conditions, our engineers will cooperate with you. Send for Bulletin 34 covering applications.

HOISTS STEAM ELECTRIC GASOLINE
Of all contractors' sizes and types

LIDGERWOOD MFG. CO., 96 Liberty St., NEW YORK

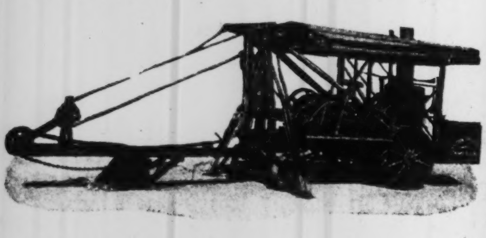
Philadelphia Pittsburgh Chicago Cleveland Los Angeles Seattle Detroit London, England
Woodward, Wight & Co., New Orleans Canada, Canadian Allis-Chalmers, Ltd., Toronto

KEYSTONE

Road Grader
Bank Dipper
Ditcher
Cellar Digger
Back Filler

5 in 1

Don't buy 40 tons of equipment if one *Keystone* 10-ton Traction Shovel will take care of all your work.



THE machine is sturdily built and will stand up to hard digging in cemented gravel, shale or old macadam. At the same time it is unusually light (10 tons), has a long wheelbase (10 ft.), with 54-inch tread-wheels and wide tires. No planking necessary on dry ground. Puts minimum strain on light bridges.

Skimmer and Dipper Scoops hold one-half yard. Loads 1½ yard wagon in 1½ minutes. Average daily output 250 to 400 cubic yards. Has dragline ditcher scoop for trenches, cellar digging, back-filling, etc. Ditching capacity 150 to 300 cu. yd. per day. Excavates to a depth of 20 ft.

The eleven-foot horizontal crowding movement and powerful thrust make it more efficient than other machines for shallow grading in hard material.

Saves you money in first cost, operating and moving charge, and upkeep.

Write nearest office for catalog, prices and list of near-by owners.

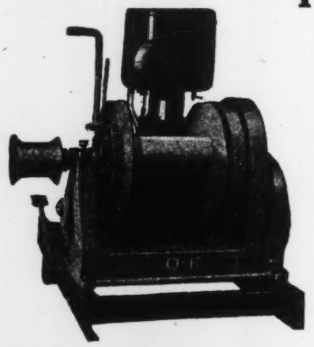
KEYSTONE DRILLER CO.

BEAVER FALLS, PA.

170 Broadway, New York. Monadnock Block, Chicago, Ill.
Joplin, Mo.

Keystone Well Drilling Machines Downie Deep Well Pumps

STEAM SHOVELS

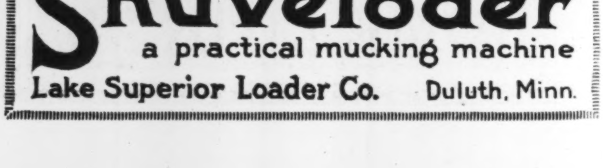


"The Hoist for

platform elevators, ore spotting, back-filling buckets, car pulling and trenches, loading and unloading cars, ships, etc., you can't beat O. K. heavy duty, single drum geaered hoist with vertical gasolnie engine.

O. K. Clutch & Machinery Co.

Columbia, Pa.



PLYMOUTH ROPE

The full page advertisement on page 48 of June 10 issue tells a story of real interest to you. There is a Plymouth Rope for every rope requirement. *Distributors in All Large Cities.*

PLYMOUTH CORDAGE COMPANY

North Plymouth, Mass. Welland, Can.

"Mechanize Underground" with the

Shuveloder

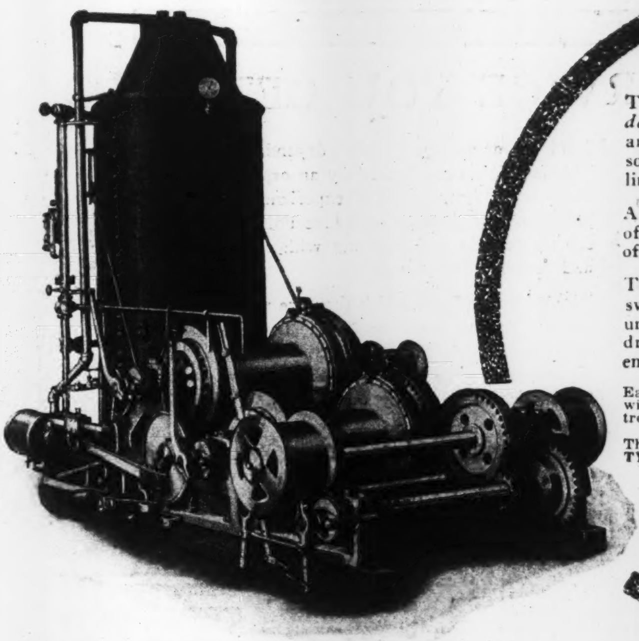
a practical mucking machine

Lake Superior Loader Co. Duluth, Minn.

BOOM SWINGING—HEAVY HOISTING SERVICE

POWERFUL DRIVE

SPEED—EASY CONTROL



The swinging drums of this *double cylinder, double friction-drum hoisting engine* are keyed to a front jack shaft and are so separated that all hoisting and swing lines run clear.

A single latched lever within easy reach of the operator controls the whole swing of the boom.

The "slack" is provided for — and the swing cable is wound upon one drum and unwound on the other. Besides, the swing drum speed is ample to meet any emergency.

Each hoisting drum is bronze bushed, equipped with powerful ratchets and pawl, and is controlled by a sturdy foot brake.

The friction is of the powerful **DOUBLE "V" TYPE** bolted to special cut tooth gears.

This gives you the barest outline—our Bulletin No. 131 will give you details. Let us send you one.

ORR & SEMBOWER, Inc., Reading, Chicago, Philadelphia, New York, Boston, Detroit

---

PENFLEX METAL HOSE

Flexibility of rubber; durability of metal; withstands heat or cold. Does not kink, crush or flatten.

Pennsylvania Flexible Metallic Tubing Co.
Broad and Race Streets, Philadelphia
Branches in all principal cities.

We Dig and Refill Trenches

For water, sewers, gas, conduits and drains
Pipe laid by contract and installation of water systems.

Trench Machines and Backfillers For Rent

W. G. FRITZ CO., INC., *Contractors*
Essex Bldg., Newark, N. J.

BACON & FARREL
ORE & ROCK
CRUSHING & WORLD KNOWN

ROLLS-CRUSHERS

EARLE C. BACON, ENGINEER
HAVEMEYER BUILDING, NEW YORK

THE UNION LINE

Consists of pile driving, excavating machinery, road builders, and contractors' equipment.
Watch our full page ads every other week on this line.

Union Iron Works
Lackawanna Siding, Hoboken, New Jersey

JUST
OFF THE
PRESS

Send a Postcard for New Catalog No. 21

MILBURN Carbide Lights

Describing in detail the new scientific generation principle which makes the Milburn lights more reliable, economical, and effective than any other lights on the market.

Send for the new catalog today.

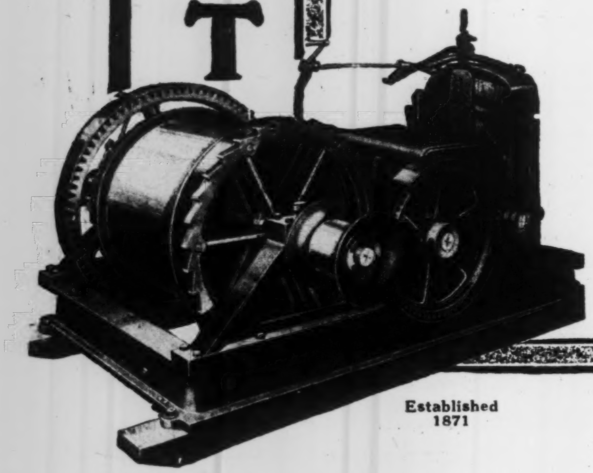
THE ALEXANDER MILBURN COMPANY
1420-142 W. Baltimore St., Baltimore, Maryland
NEW YORK PHILADELPHIA PITTSBURGH CHICAGO

THOMAS HOIST

THE SERVICE YOU GET

from Thomas Hoists is dependable. Thomas Hoists are backed by an organization with forty years of experience in perfecting a hoist that will give uniform service year in and year out with speed and economy in operation.

The materials from which they are made—the features, such as band friction, which they embody, are reflected by the service they give—a service that cannot be duplicated with any other hoist.



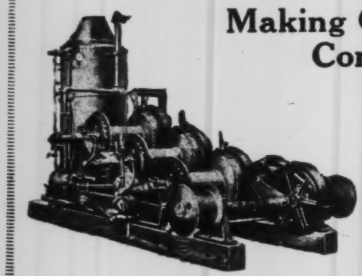
Thomas Elevator Co.
22 So. Hoyne Avenue
CHICAGO

BRANCH OFFICE:
Park Row Bldg., New York City

Established
1871

ETCo

Making Good for the Contractor



is a habit with this

FLORY
Three Friction Drum Engine

Specially adapted for operating boom derricks at quarries, on scows and for general contractor's work.

S. FLORY MFG. CO.
***Main Office and Works:* Bangor, Pa.**
New York: 95 Liberty St. Pittsburgh: 1st Nat'l Bank Bldg.
Chicago: Monadnock Block Hartford, Conn.: K. B. Noble Co.

Dirt-Movers Use the Dragline Cableway Method of Digging and Moving Materials

The ability of the Sauerman Dragline Cableway Excavator to dig from either above or below water, and to elevate and convey the material from pit to plant without the help of auxiliary machinery, has made it standard equipment for commercial gravel handling operations. This same ability makes our type of equipment correspondingly economical and efficient for other propositions where material has to be excavated and moved over distances from 100 to 800 feet or more.

Write for complete information

SAUERMAN BROS.
53 W. Jackson Blvd., Chicago

Dobbie Derricks and Hoists

Stock of Fittings, Blocks, Sheaves, Winches, etc., carried by our agents—

G. S. Green Co., New York.
Beckwith Machy. Co., Pittsburgh.
Beckwith Machy. Co., Cleveland.
P. I. Perkins Co., Boston.

DOBBIE Foundry & Machine Co.
Manufacturers
Niagara Falls, N. Y.

CRANES OF ALL TYPES

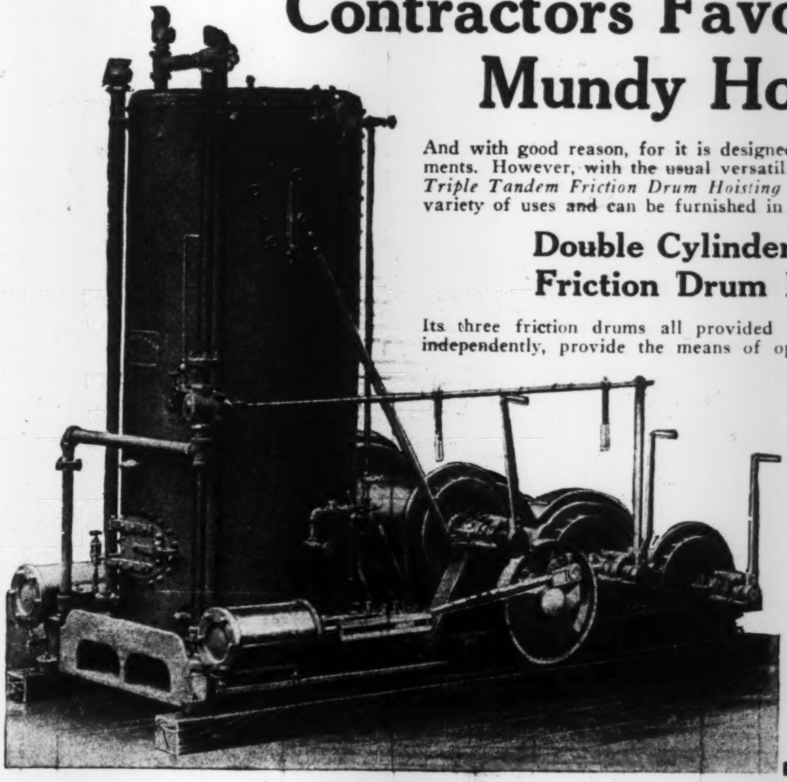
WHITING
FOUNDRY EQUIPMENT CO
HARVEY-ILL. U. S. A.
CHICAGO SUBURB

FOUNDRIES EQUIPPED COMPLETE

GREY STRAND WIRE ROPE
ELECTRICALLY WELDED WIRE

Wickwire Spencer Steel Corporation
Worcester, Mass. **Buffalo, N. Y.**

Branch Offices and Warehouses
New York Philadelphia Chicago Boston
San Francisco Tulsa, Okla.



Contractors Favor This Mundy Hoisting Outfit

And with good reason, for it is designed and built with a view to their requirements. However, with the usual versatility of Mundy hoists, this *Double Cylinder Triple Tandem Friction Drum Hoisting Engine* with Boiler is adapted to a wide variety of uses and can be furnished in a number of sizes.

Double Cylinder Triple Tandem Friction Drum Hoisting Engine

Its three friction drums all provided with pawls and ratchets, each working independently, provide the means of operating a derrick, of handling a clamshell bucket or for doing any work where it is necessary to operate three hoisting lines.

This engine can also be furnished with the Mundy Patented Derrick-Swinging Drum.

If the Handling of Material is a function of your business, *do it with a Mundy.*

We will be glad to submit our specifications

J. S. Mundy
Hoisting Engine Company
722-740 Frelinghuysen Ave.
Newark, N. J.

PROMPT SHIPMENTS

Steel Plate Piping for Blast and Gas Mains
Plate Work for Blast Furnaces and Hot Blast Stoves

TOW BOATS, BARGES, ETC.

THE DRAVO CONTRACTING COMPANY
Engineering Works Department

Address inquiries to:

DRAVO-DOYLE COMPANY

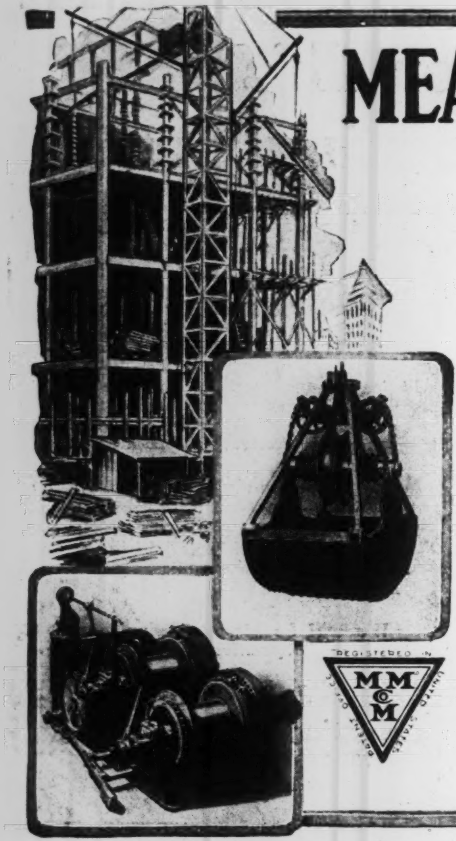
PITTSBURGH PHILADELPHIA CLEVELAND INDIANAPOLIS CHICAGO

O'ROURKE ENGINEERING CONSTRUCTION CO.

Whitehall Building, 17 Battery Place, New York

JOHN F. O'ROURKE, *President and Chief Engineer* HENRY A. ALKER, *Vice President*

PREPARED at all times with an ample plant and with exclusively controlled new, safe, economical and non-disturbing methods to undertake construction of deep **FOUNDATIONS, SUBWAYS** and river or land **TUNNELS.**



MEAD-MORRISON SERVICE

LIFTS THE LOAD OF INDUSTRY

More Productive Hours! To increase the productive hours o the nation's industry is the goal toward which Mead-Morrison engineers are working. That their ideals and their methods are sound is indisputably shown by their practical success in solving the materia handling problems in many lines of industry.

The value of Mead-Morrison equipment to the individual use is made materially greater by this engineering service, which assist in making sure that every piece of equipment is utilized in a wa that will bring maximum results at a minimum cost.

Mead-Morrison Engineers are recognized as authority on material handling equipment because of their service to the world of industry in designing, manufacturing and installing labor-saving plant at many of the largest freight terminals, coal and ore docks.

Mead-Morrison products—Hoists, steam or electric; Grab Buckets; Conveyors; Car Pullers and Winches—are recognized equipment for efficient, economical material handling.

Machinery Agents: If you are handling contracting machinery and would like a complete hoisting line, we have some good territory open. We carry complete stocks of equipment in Boston and Chicago, ready for prompt shipment. Write at once for complete information.

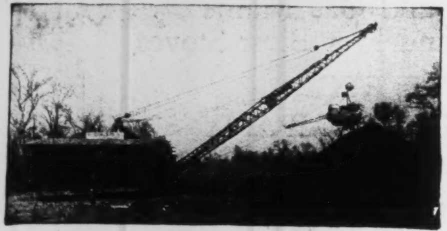
MEAD-MORRISON MANUFACTURING CO.
529 Prescott St., East Boston, Mass.
Welland, Canada

Singer Building
New York

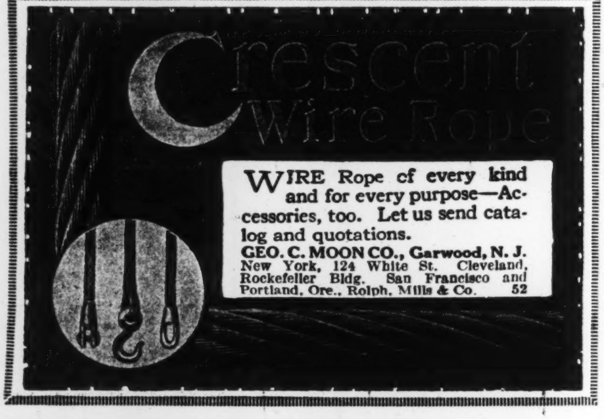
265 Beaver Hall Hill,
Montreal

Monadnock Bloc
Chicago

Monighan Dragline



Monighan Machine Co.
2036 Carroll Ave., Chicago



WIRE Rope cf every kind and for every purpose—Accessories, too. Let us send catalog and quotations.

GEO. C. MOON CO., Garwood, N. J.
New York, 124 White St. Cleveland, Rockefeller Bldg. San Francisco and Portland, Ore., Rolph, Mills & Co. 52

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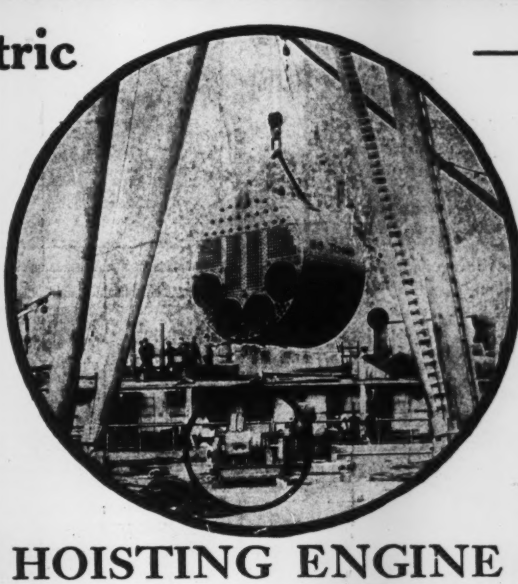

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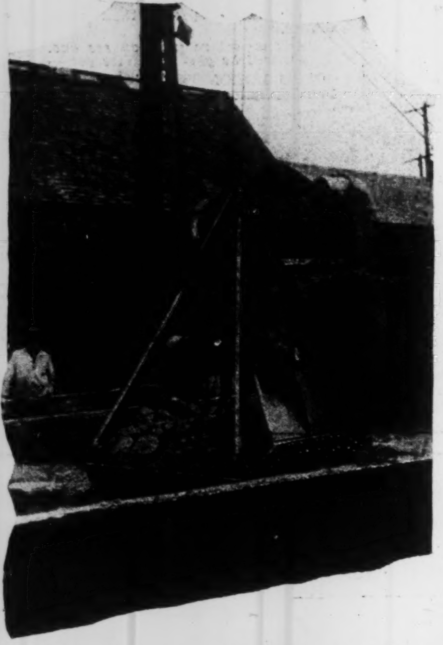
Handling Pumped Sand



ONE of the most difficult materials to dig or handle is pumped sand.

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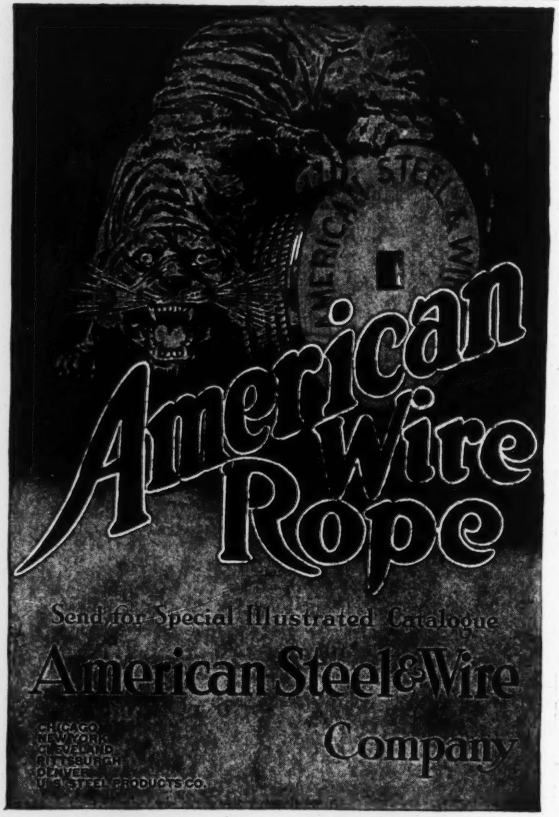

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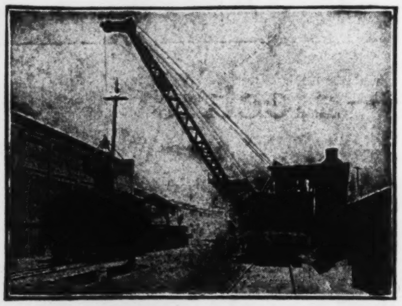

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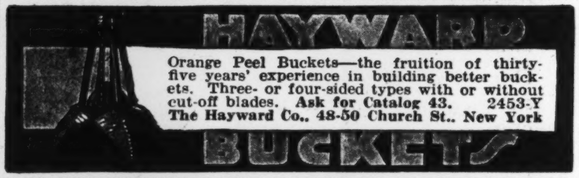

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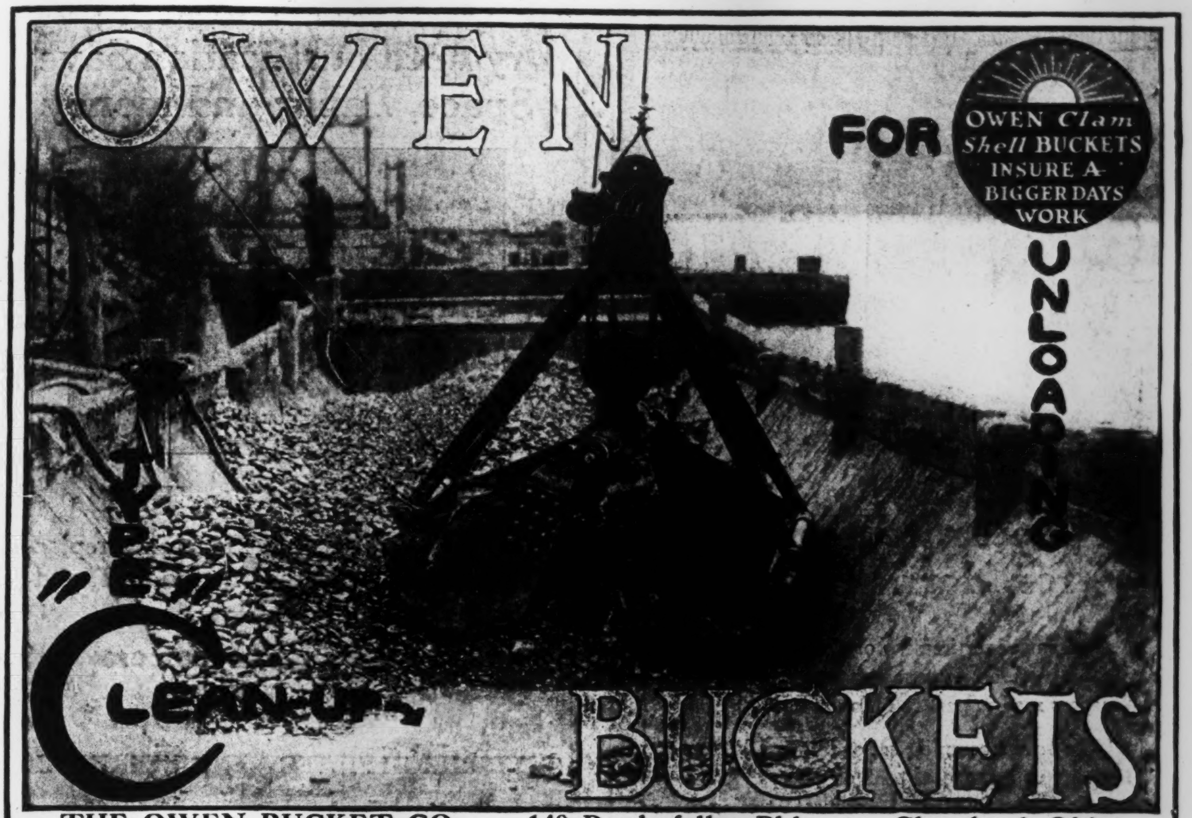
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Its Strength and toughness make it durable, safe and economical
THE ORIGINAL COLORED STRAND WIRE ROPE
MADE ONLY BY
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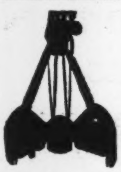

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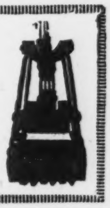

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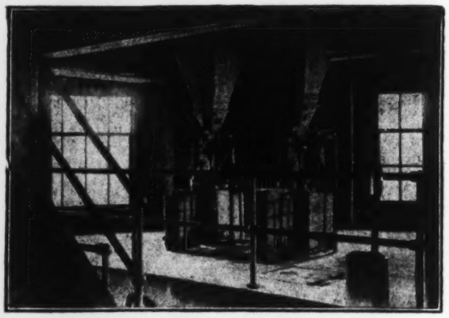

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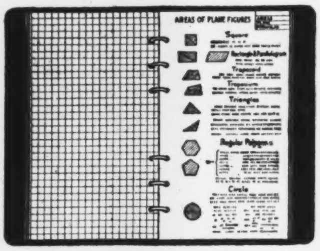

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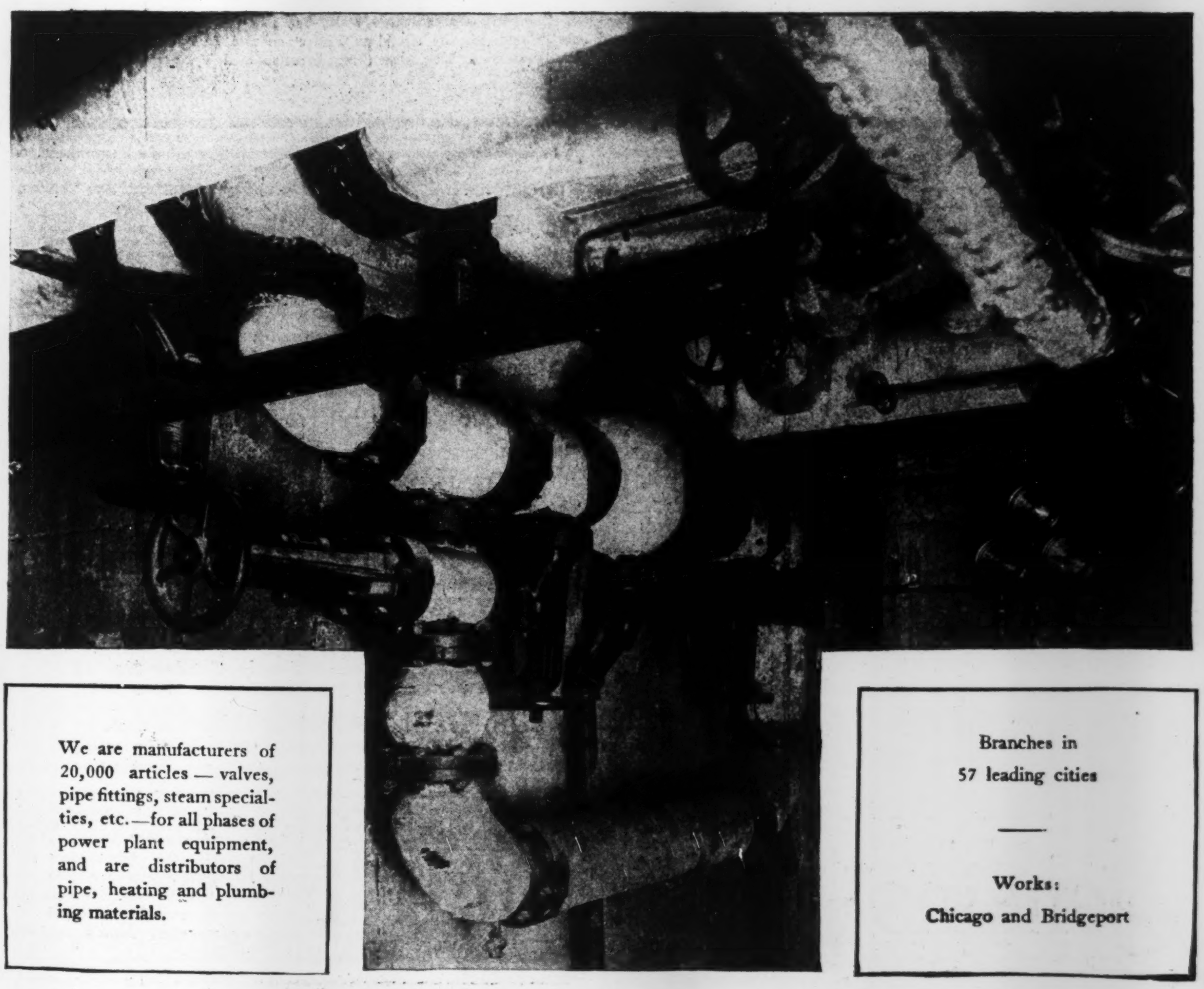

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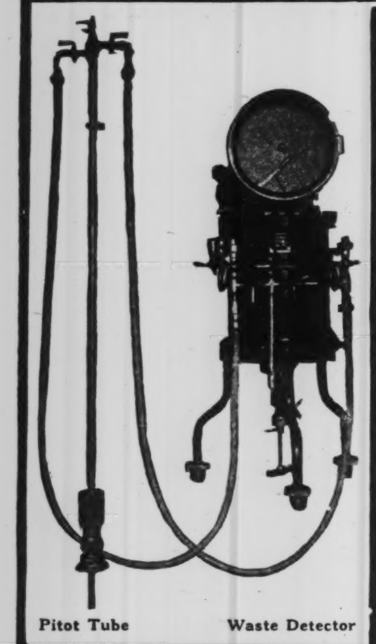

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Jenkins Brass Swing Check Valves (Standard Pattern)

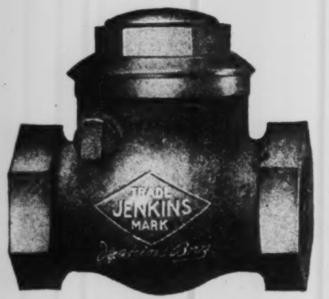

Figure 352

Strong, durable check valves. Have Jenkins Renewable Disc feature.

Valve opens readily at low pressures and the shock of closing under high pressure in the most severe service is absorbed in the line piping.

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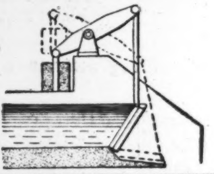

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In consequence we maintain a skilled staff of water service men. A member of this field staff will visit your installation on request and stay until your gangs are laying Michigan Pipe fast and RIGHT.

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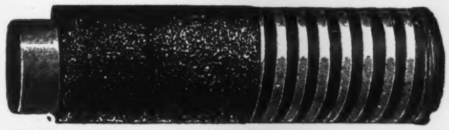

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Carries 17½ to 25 per cent more water than iron or steel and lasts longer.

Unaffected by frost, electrolysis, acid fumes or corrosion. Durable and economical.

For three score and five years it has been giving satisfactory service.

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It didn't take any time at all, and this thread is just as clean as a whistle.

Yes sir, I sure do like the FORBES'!

The Forbes' Pipe Threading and Cutting Machine will fit your requirements. Made in all sizes, for hand, belt or motor drives, and equipped with cast iron base if desired.

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30° 30°
IT THREADS PIPE ACCURATELY

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This Mark on a Casting—

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The *Lock Bar Steel* Pipe is made either with overlapping or riveted taper transverse joints of the ordinary type—or with a special type of bolted flexible joint that is easily applied and requires no field equipment.

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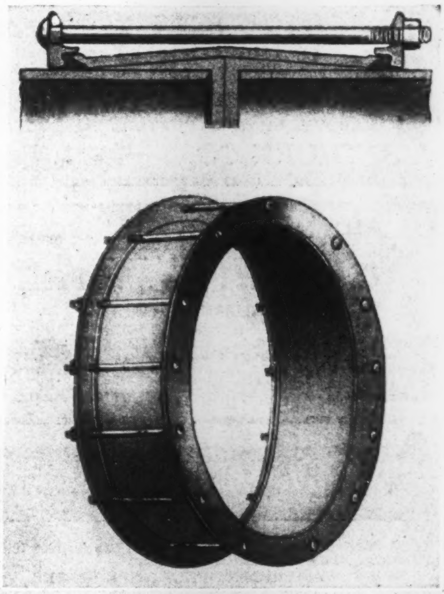
This gives you a flexibility of installation unsurpassed by any type of metal pipe.



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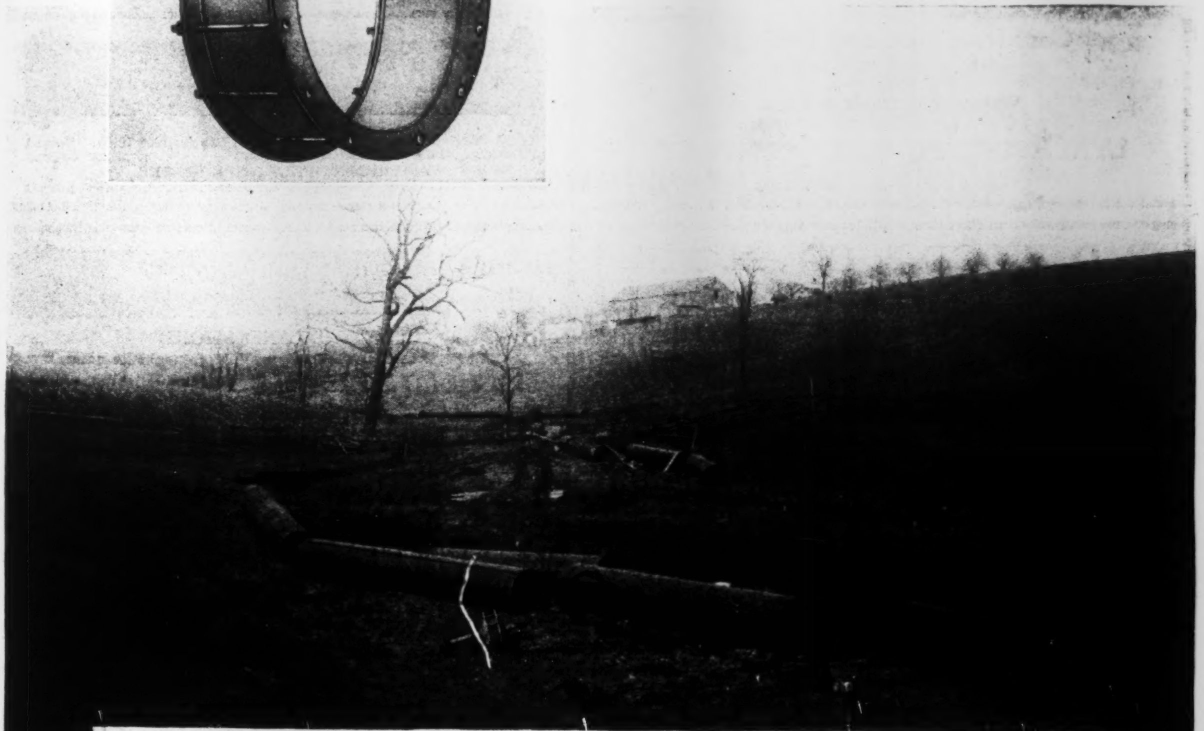

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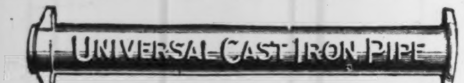

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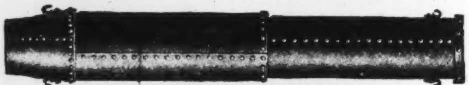

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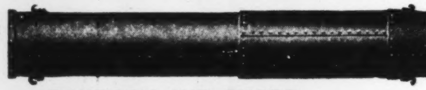

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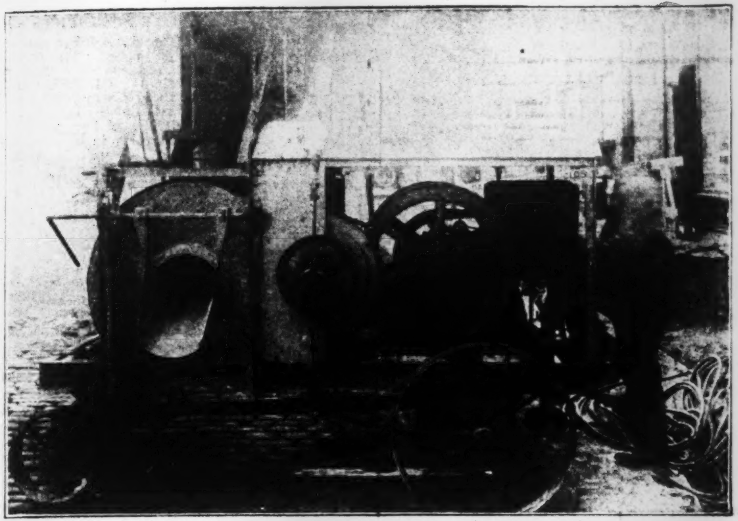

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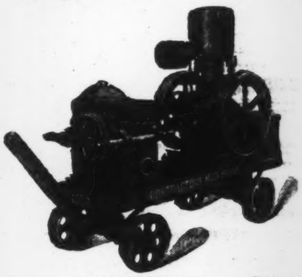
No Boiler, Engineer or Fireman is Required for Our Contractor's Pump



'It has an extreme high lift, capable of producing 24-in. vacuum. Being double in action, it gives a continuous flow of water. Its two diaphragms being placed vertically, grit cannot lodge and cut them. Working horizontally, it does away with all overhead work. Mounted on solid truck, it is easy to move from place to place. Its compactness reduces needed floor space to only 2 x 5 feet. Its weight is 1000 lbs. Has no plunger, plunger packing, stuffing boxes or spring valves.

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Centrifugal
pumping machinery for every kind of pumping service.

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Fittings of All Sizes

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Camden Iron Works
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An electrically driven unit for continuously pumping a large volume of water.

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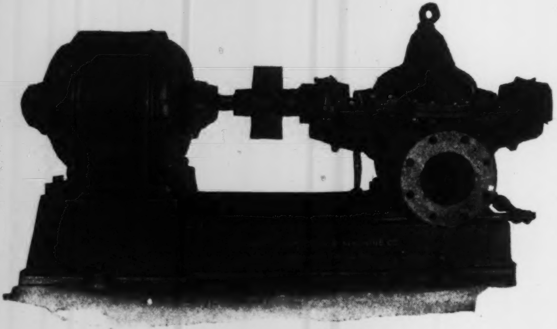

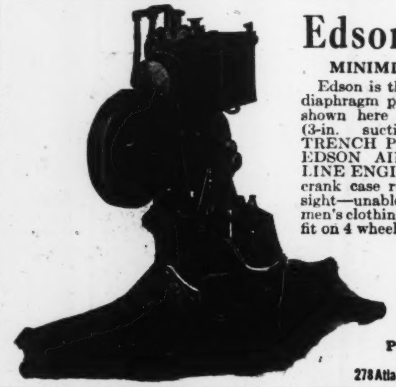

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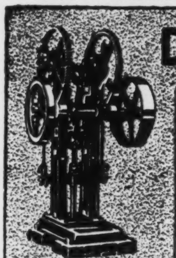

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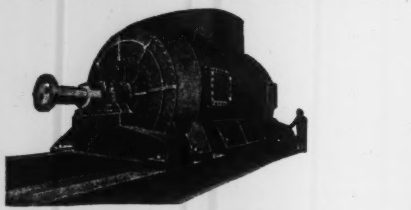

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Domestic Diaphragm Power Pump

Simple
Powerful
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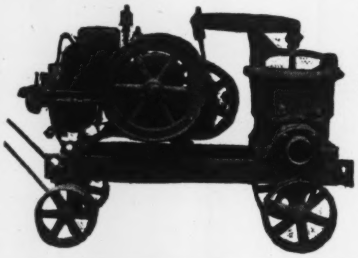
Has Non-Clog Valves, straight lift, integral gearing and High Tension Magneto.

Pump designed expressly for power. Has double the capacity of the average diaphragm pump



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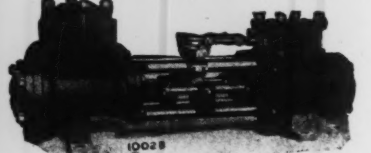
Domestic Engine & Pump Co.
Shippensburg, Pa.



The valve Movement of Dean Bros. Durable Duplex Steam Pump is the most important improvement that has been made on a Duplex Pump in Twenty-five years.

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You can replace several hand pumps with one Atlantic. It will remove water from any of your excavations economically and quickly. Always dependable. Get full details immediately

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Waldo Bros., Inc. Established 1869 and Harold L. Bond Co. Established 1900
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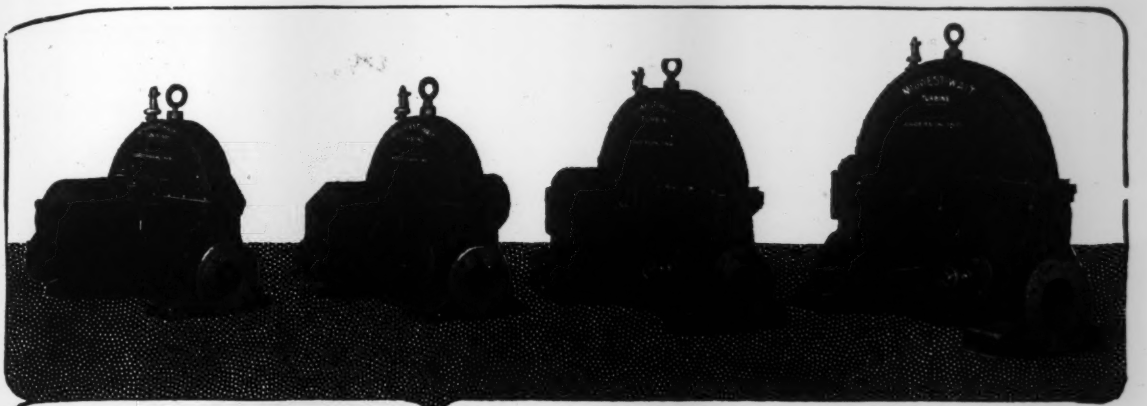

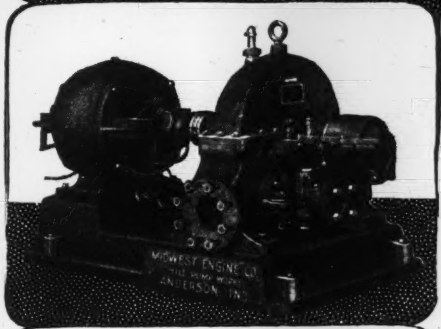

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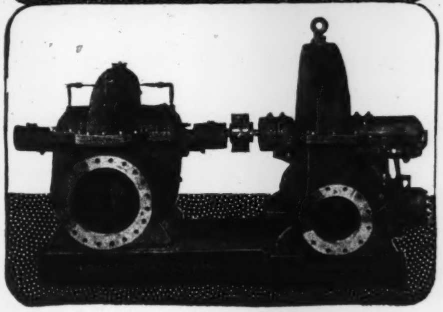
In the Representative Plants of Every Industry

Midwest-Wait Steam Turbines are used in numbers by the foremost concerns in every line—



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Some of these companies use as many as SEVENTY Midwest-Wait Steam Turbines purchased over a period of several years.

The most reliable and economical form of Power. Flexible and as easily handled as an electric motor.

Midwest-Wait Steam Turbines are unusually efficient, the steam consumption per B. H. P. hour is remarkably low.

Used in every class of service where economy of fuel, high efficiencies and space are factors.

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Midwest—Centrifugal, Reciprocating and Deep Well Pumps and Auxiliaries
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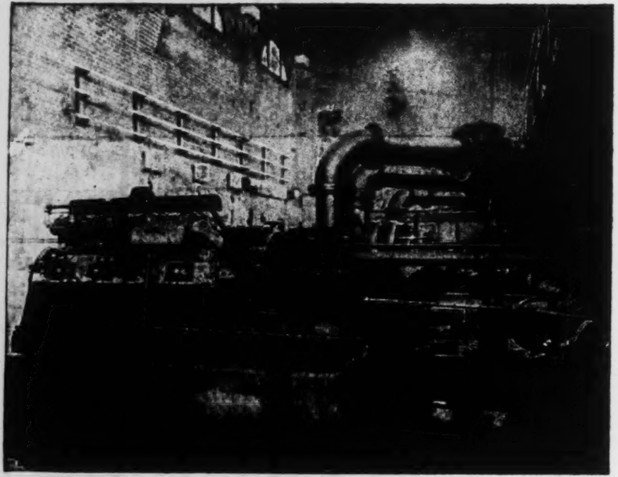
Dependable Power

Sterling
THE ENGINE of REFINEMENT
For the finest boats that float

TWO HUNDRED HORSEPOWER FOR $3350
(*Higher or lower power at proportionate prices*)



Model FC 8-cylinder, 200 H.P. Sterling direct connected to Dayton-Dowd High Pressure fire pump at Three Rivers, Que., for fire protection. Sterlings are equal to any emergency caused by the loss of steam power, through coal shortage, breakage of pipes, strikes, etc., or loss of electric current.

Compare the cost of a Sterling gas or gasoline engine with the cost of equivalent power in other prime movers.

Can you afford to be without an emergency power plant?

Better send for our catalog today

STERLING ENGINE CO.
Dept. C.
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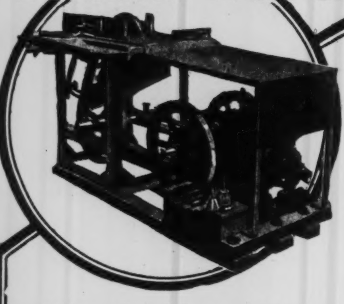
4, 6 and 8-cylinder, 12 to 300-H.P., speeds of 400 to 1500 r.p.m. for centrifugal fire pump and electric generator drives.

FAIRBANKS-MORSE
Portable Wood Worker



With attachments for molding, mortising, rabbeting, jointing, matching, boring, sand papering, tool grinding, sawing irregular shapes and tongue and groove work.

Here's Your Wood Worker

It will pay for itself over and over again by saving time, utilizing waste lumber and in dozens of other ways. Has the famous Fairbanks-Morse "Z" Engine with Bosch Magneto and runs on kerosene. Send for Bulletin C-7054.

CONTRACTORS' EQUIPMENT DEPT.
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30 CHURCH ST. - NEW YORK CITY

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VORTEX PUMPS

They excel in efficiency and endurance. Built to operate against all heads up to 125 feet. Perfectly balanced laterally. No end thrust. Not high in price.

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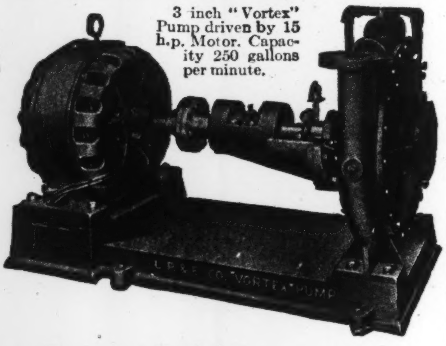
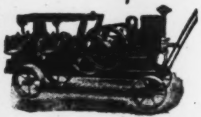


3 inch "Vortex" Pump driven by 15 h.p. Motor. Capacity 250 gallons per minute.

The Lawrence Pump and Engine Co.
P. O. Box 70, Lawrence, Mass. New York Office, 90 West St.



There is Power—Plus
with a capacity of 5,000 to 6,000 gal. per hour with the
Cascade Trench Pumper
Write today for booklet.
Every Contractor needs one.
Van Nouhuys' Machine Works
Albany, N. Y.

We are Designers and Builders of
Hydraulic Dredges
and
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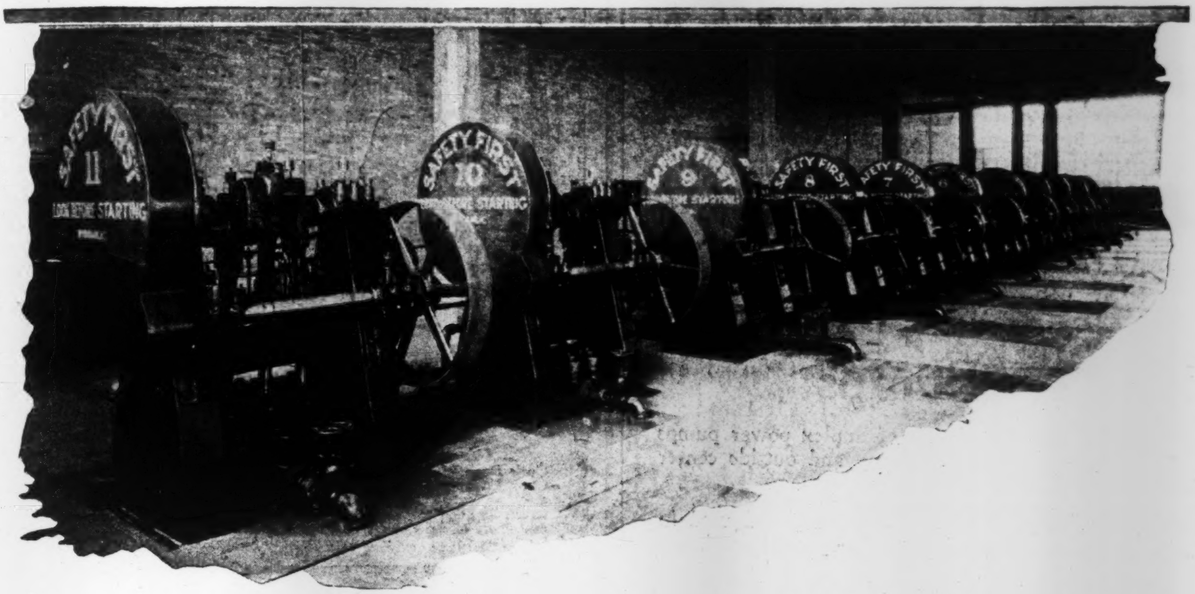
See page ad. every other week
Ellicott Machine Corporation
Baltimore, Md.

Every Goulds Pump is Guaranteed to satisfactorily perform the specific work for which it is sold



Eleven Goulds Pumps in the Wax Plant of the Sinclair Oil Refinery

This battery of Goulds Pumps is used for pumping oil in the East Chicago wax plant of the Sinclair Oil Refining Co. The battery consists of nine Goulds Triplex Pumps Fig. 1671 4½ x 8, 60 GPM., 500 lbs. pressure, at 37 RPM. and two Goulds Pumps Fig. 1671, 2½ x 8, 15 GPM., 1800 lbs. pressure, at 30 RPM.

Wherever used for pumping oil, water or other liquids Goulds Pumps make good. The sturdy, rugged construction and simple design account for their long life and low maintenance charges.

Complete information covering the entire line of Goulds Pumps is at your command.

Our Engineering Department is pleased to render assistance on the selection of the most suitable type and size pump for any installation.

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STRENGTH DURABILITY EFFICIENCY
FOR EVERY SERVICE

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STEAM AND POWER DRIVEN
DURABLE McG PUMPING MACHINERY EFFICIENT
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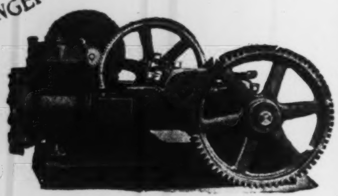


FIG. 404
Packed Piston Pump
Side Motor Mounting

McGowan Duplex Power Driven Pumps

The valve plate design of duplex power pumps is built in the packed piston and outside center packed plunger patterns.

The sizes correspond to the pump end used in McGowan Duplex Steam Pumps and are interchangeable with them.

They are adopted for all modern types of drives and have many special advantages. If interested write for bulletin today.

The John H. McGowan Co.
Cincinnati, Ohio

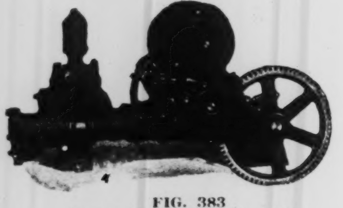
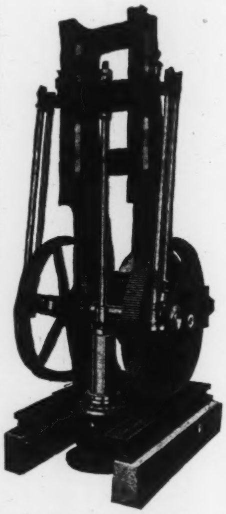


FIG. 383
Center Packed Plunger Pump
Top Motor Mounting

A. D. Cook
Lawrenceburg, Indiana
Manufacturer of

Steam and Power Deep Well Pumps, Single and Double Acting; Cook's Patent Brass Tube Well Strainers; Deep Well Cylinders; Sucker Rods and Well Tools.

Deep Well Pumping Systems installed complete.



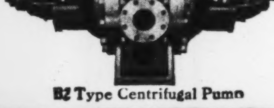
Cook Single Acting Deep Well Power Head

Write for Catalog No. 11-G

Cook Patent Brass Tube Well Strainer

Cook Deep Well Products have always been manufactured by A. D. Cook, Lawrenceburg, Ind., The Cook Well Company of St. Louis, Mo., a selling organization, has retired from active business and has transferred its good will and records to A. D. Cook and in the future the customers of the Cook Well Company will receive direct service upon Cook Deep Well Products by writing to A. D. Cook, Lawrenceburg, Ind.

RoTURBo

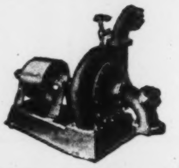


B2 Type Centrifugal Pump

ROTURBO CENTRIFUGAL PUMPS AIR PUMPS
MADE BY MANISTEE
ROTARY JET CONDENSERS

Manistee Iron Works Co. MANISTEE, MICH.

ERIE
SAND-GRAVEL DREDGING PUMPS



will handle your liquids with solids in suspension at the minimum cost. Belt, motor or steam direct drive.

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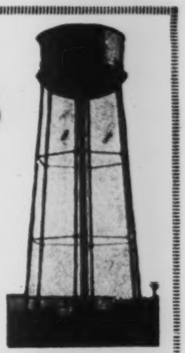
ERIE PUMP & ENGINE WORKS
Formerly of Erie, Pa. **MEDINA, N. Y.**

Centrifugals

We specialize on single stage low head centrifugal pumps.
Ask for Catalog
TABER PUMP CO.
294 Elm St., Buffalo, N. Y.



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Elevated Steel Water Tanks—Storage Tanks—Self-Supporting Steel Stacks—All Classes Heavy Plate Metal Work

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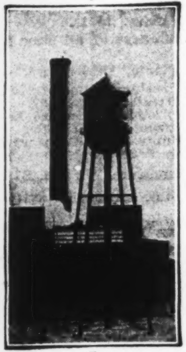
Steel Stack
31 ft. dia. x
400 ft. high

Storage Tank
94 ft. x 29 ft. high.

250,000 Gal. Tank.
Camp Grant.



Elevated Steel Tanks

Stand Pipes

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Steel Stacks

Wireless Towers

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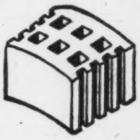

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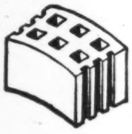

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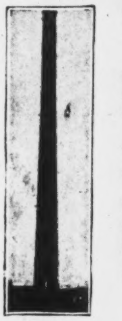

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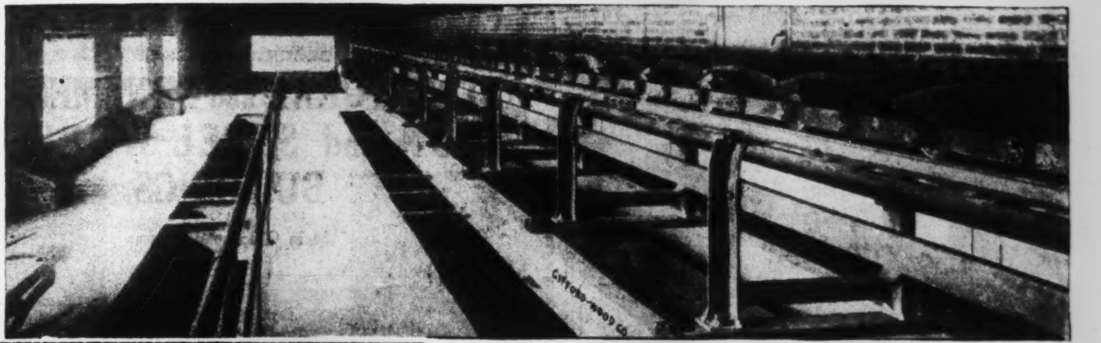

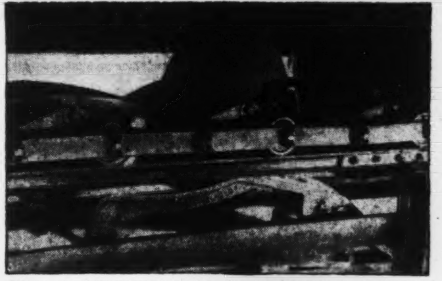

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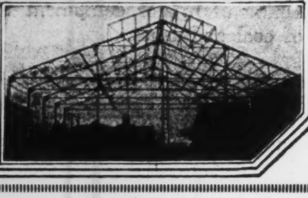

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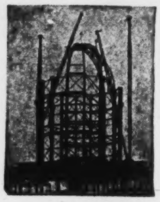

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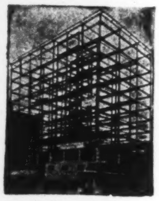

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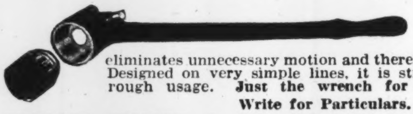

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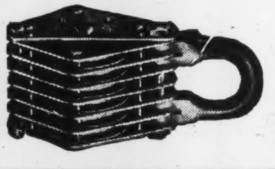

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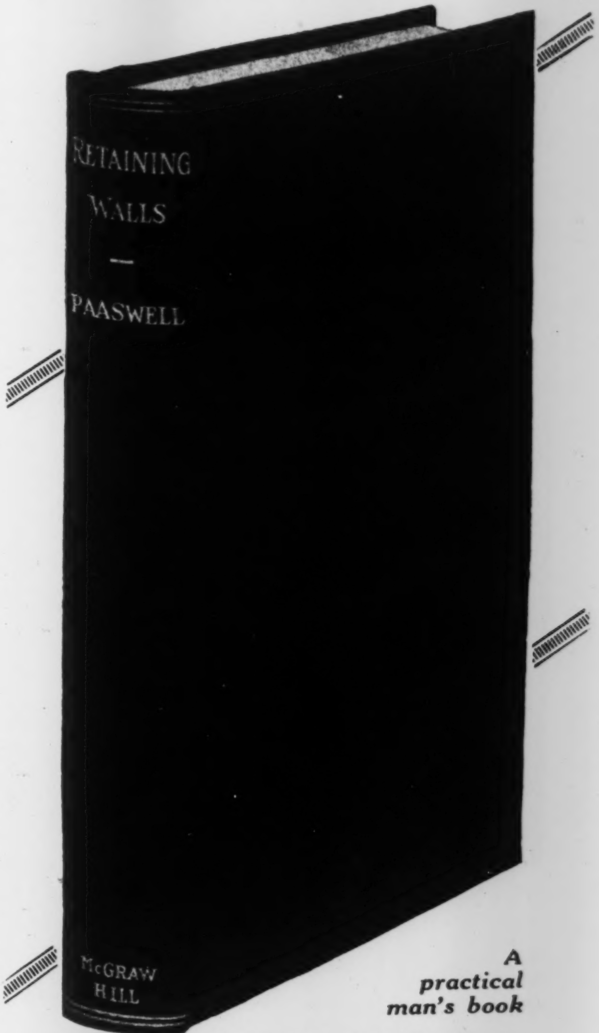

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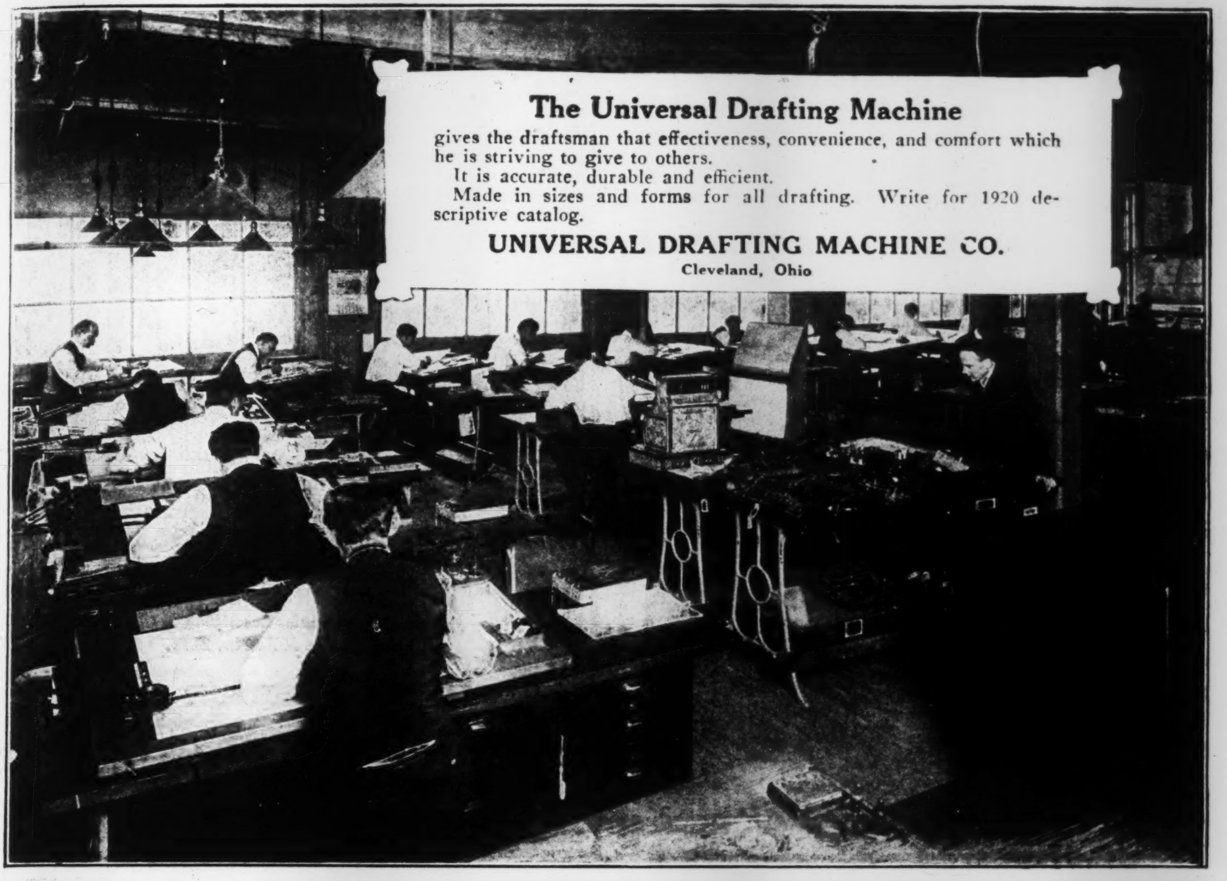

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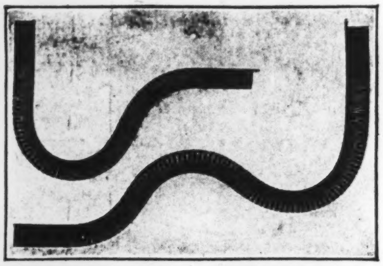

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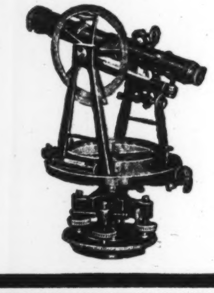

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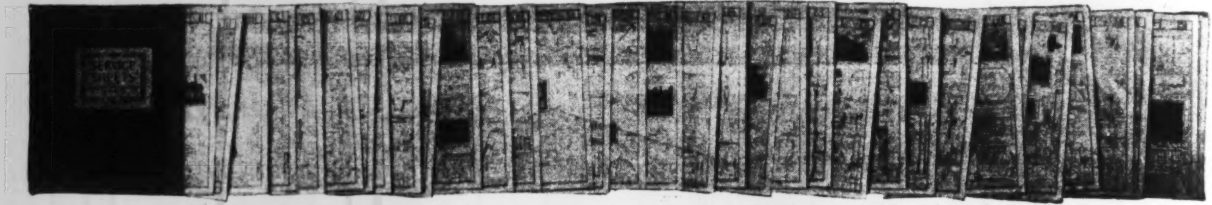

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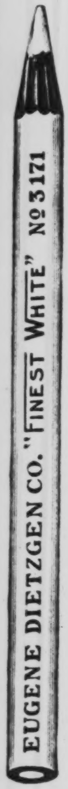
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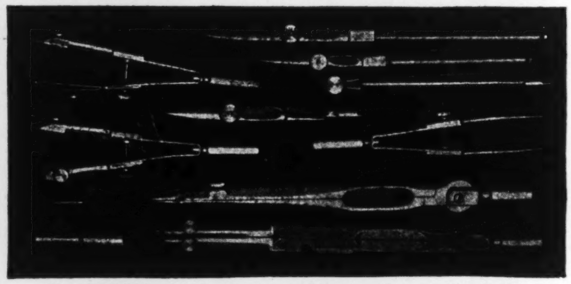

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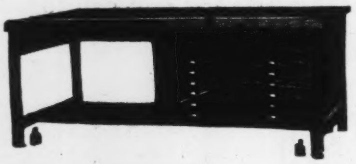

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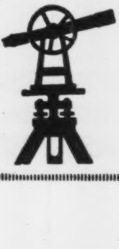

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- Worthington Pump & Machy. Corp.

Conveyors, Belt
- Gifford-Wood Co.
- Jeffrey Manufacturing Co
- Link-Belt Company
- Portable Machy. Co.
- Robins Conveying Belt Co
- Smith Engineering Works
- Webster Mfg. Co.

Conveyors, Bucket
- Gifford-Wood Co.
- Jeffrey Mfg. Co.
- Link-Belt Company
- Webster Mfg. Co.

Cordage, Manila & Sisal
- Plymouth Cordage Co.
- Whitlock Cordage Co.

Corner Bead, Metal
- Berger Mfg. Co.
- Consolidated Expanded Metal Cos.
- Truscon Steel Co.

Cranes, Locomotive
- Amer. Hoist & Derrick Co
- Ball Engine Co.
- Brown Hoisting Machy. Co
- Browning Co., The
- Byers Machine Co., John F
- Clyde Iron Works
- Davenport Locomotive Wks
- Industrial Works
- Link-Belt Company
- Locomotive Crane Co. of America
- McMyler Interstate Co.
- Marion Steam Shovel Co
- Northwest Engr. Wks.
- Ohio Locomotive Crane Co
- Orton & Steinbrenner Co.
- Osgood Co., The
- Terry Mfg. Co., Edw. F.
- Thew Auto. Shovel Co.

Cranes, Traveling
- Brown Hoisting Machy. Co
- Link-Belt Company
- Pawling & Harnischfeger Co
- Toledo Bridge & Crane Co.
- Whiting Fdry. & Equip. Co

Cranes, Wrecking
- Bucyrus Co.
- Browning Co., The
- Industrial Works

Creosoted Blocks, Timber, etc.
- American Creosoting Co.
- Jennison-Wright Co.
- Ohio Wood Preserving Co.
- Republic Creosoting Co.
- S. P. F. Wood Preserv. Co

Creosoting and Creosoting Oils
- American Creosote Works
- Barber Asphalt Paving Co
- Barrett Co.
- Carbolineum Wood Preserving Co.
- Jennison-Wright Co.
- Northeastern Co.
- Republic Creosoting Co.
- Wyckoff Pipe & Creosoting Co.

Crushers and Pulverizers
- Allis-Chalmers Mfg. Co.
- Bacon Co., Earl C.
- Jeffrey Manufacturing Co
- Orton & Steinbrenner Co
- Raymond Bros. Impact Pulverizer Co.
- Smidth & Co., F. L.
- Smith Engineering Works
- Universal Road Machy. Co
- Worthington Pump & Machy. Corp.

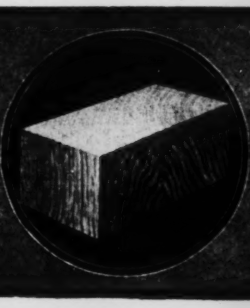
Culverts, Corrugated
- Canton Culvert & Silo Co.
- Newport Culvert Co.

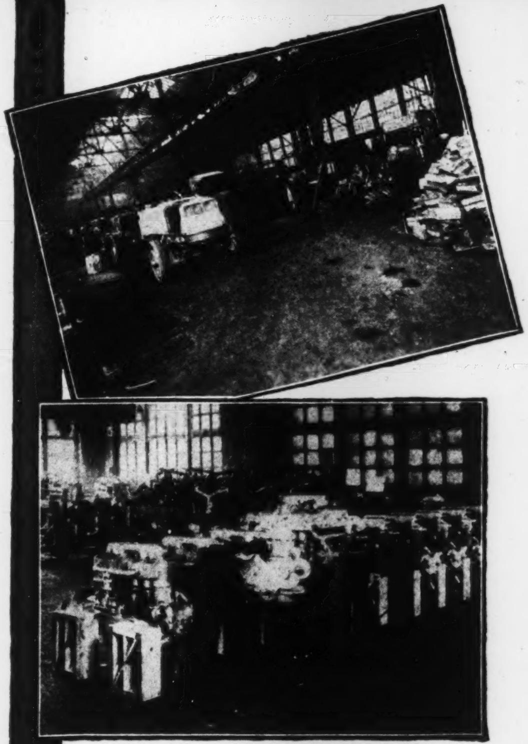
Culverts, Metal
- American Sheet & Tin Plate Co.
- Amco Iron Culvert & Flume Mfgrs. Assoc.
- Newport Culvert Co.
- U. S. Cast Iron Pipe & Fdry. Co.

Culverts, Netable, Riveted Corrugated
- Canton Culvert & Silo Co
- Newport Culvert Co.

Curb, Steel Protected
- Truscon Steel Co.

Kreodone EVERLASTING [illegible] BLOCK FLOORS





Peerless Motor Car Co., Cleveland, Ohio, E. McGeorge, Engineer. ***(We have several repeat orders from this company.)***

Solved!

THE Peerless Motor Car Co. long ago solved its floor problems—with KREODONE.

Exhaustive experiments proved that a KREODONE Wood Block Floor coupled simplicity of construction with permanence in a degree heretofore absent in any other floor material.

They found first cost surprisingly low and up-keep costs practically an unknown quantity.

Also that KREODONE required practically no pre-arrangement for installation. Any time was the right time as it did not interfere with production.

That's the kind of floor you need—always in condition, proof against decay and with the wear of steel.

It is easy to trace the success of each KREODONE floor to the outstanding fact that each block is made from long-leaf yellow pine and thoroughly treated with our own, patented, PURE creosote oil.

From our early pioneering days of over twenty years ago, we have builded on this solid foundation for our present success.

Get the Genuine KREODONE Blocks
Watch that Spelling—it means Service

Republic Creosoting Company, Indianapolis, Ind.

Plants: Indianapolis Minneapolis Mobile Seattle Norfolk

BRANCH OFFICES:

315 Peoples Gas Bldg., Chicago
206 Erie County Bank Bldg., Buffalo
152 Bay Street, Toronto, Canada
638 Old South Bldg., Boston
Berkley Ward, Norfolk
222 Society for Savings Bldg., Cleveland
834 Real Estate Trust Bldg., Philadelphia
828 Plymouth Bldg., Minneapolis
445 Central Bldg., Seattle
Masonic Temple, Mobile
211 Hammond Bldg., Detroit
735 M & M Bank Bldg., Milwaukee

Cutting Blowpipes, Oxy-Acetylene
Milburn Co., Alex., The

Dams
O'Rourke Eng. Constr. Co.

Derricks and Derrick Fittings
Amer. Hoist & Derrick Co.
Byers Machine Co., John F.
Clyde Iron Works
Dobbie Fdry. & Mach. Co.
Hayward Co.
Insley Manufacturing Co.
Lambert Hoisting Eng. Co.
Lidgerwood Mfg. Co.
McMyler Interstate Co.

Disinfecting Chemicals
Mathieson Alkali Works
Wallace & Tiernan, Inc.

Distributors, Pressure Oil
(See Road Oilers, Pressure)

Ditching Machinery
(See Excavators)

Diving Apparatus
Morse & Son, A. J.

Docks and Harbor Work
Snare & Triest Co.

Doors & Shutters, Steel Rolling
Detroit Steel Products Co.
Kinnear Mfg. Co.
Lupton's Sons Co., David

Drafting Machines
Universal Drafting Machine Co.

Drafting Room Furniture
Defiance Mfg. Co.
Dietzgen Co., Eugene
Economy Drawing Table & Mfg. Co.
Hamilton Mfg. Co.
Univ. Drafting Mach. Co.

Drawing Materials
Dietzgen Co., Eugene
Hamilton Mfg. Co.
Keuffel & Esser Co.
Kolesch & Co.
Vincent Co., Geo.

Drawing Tables
(See Tables and Boards, Drawing)

Dredges
Hayward Co.
Lambert Hoisting Eng. Co.
Lidgerwood Mfg. Co.
Osgood Co., The
Marion Steam Shovel Co.
Vulcan Iron Wks. of N. J.

Dredges, Dipper
Austin Machy. Corp.
Bay City Dredge Works
Bucyrus Co.
Osgood Co.

Dredges, Hydraulic
Bucyrus Co.
Ellicott Machine Corp.
Marion Steam Shovel Co.
Morris Machine Co.

Drills, Air
Ingersoll-Rand Co.

Drills, Core
Ingersoll-Rand Co.
Keystone Driller Co.
McKiernan-Terry Drill Co.
Sullivan Machinery Co.

Drills, Hammer
Ingersoll-Rand Co.
McKiernan-Terry Drill Co.
Sullivan Machinery Co.

Drills, Rock
Chicago Pneumatic Tool Co.
General Electric Co.
Ingersoll-Rand Co.
Jeffrey Manufacturing Co.
McKiernan-Terry Drill Co.
Schramm & Son, Inc., Chris. D.
Sullivan Machinery Co.

Drums, Holding
Blaw-Knox Co.
Hayward Co.
Monighan Machine Co.

Dryers
American Process Co.

Ejectors, Sewage
Pacific Flush Tank Co.

Elevator Buckets
Gifford-Wood Co.
Hendrick Mfg. Co.
Jeffrey Manufacturing Co.
Link-Belt Company
Ohio Locomotive Crane Co.
Smith Engineering Works
Webster Manufacturing Co.

Elevators, Contractors' Material
Byers Machine Co., John F.
Insley Manufacturing Co.
Oshkosh Mfg. Co.
Ransome Concrete Mach. Co.
Smith Co., T. L., The
Smith Engineering Works
Thomas Elevator Co.

Elevators, Factory
Ridgway & Son Co., Craige

Engineers and Contractors
(See also Directory of Engineers)
General Eng. & Constr. Co.
Guarantee Construction Co.
Raymond Concrete Pile Co.
Smith, Hauser & MacIsaac
Spencer, White & Prentis
Terry & Tench Co., Inc.

Engineers' and Draftsmen's Instruments and Supplies
Beckmann L., Co.
Dietzgen Co., Eugene
Gurley, W. & L. E.
Hamilton Mfg. Co.
Higgins & Co., Chas. M.
Keuffel & Esser Co.
Kolesch & Co.
Weber Co., F.

Engines, Gas, Gasoline, Oil
Allis-Chalmers Mfg. Co.
Chicago Pneumatic Tool Co.
Ellicott Machine Corp.
Ingersoll-Rand Co.
Midwest Engine Co.
Northwest Engr. Wks.
Smith Co., T. L., The
Sterling Engine Co.
Worthington Pump & Machy. Corp.

Engines, High-Duty Water Works
Morris Machine Works
Sterling Engine Co.
Worthington Pump & Machy. Corp.

Engines, Hoisting
(See Hoists)

Engines, Portable
Leffel & Co., Jas.
Worthington Pump & Machy. Corp.

Engines, Traction
Cleveland Tractor Co.

Excavators, Cableway
Clyde Iron Works
Lambert Hoisting Eng. Co.
Lidgerwood Mfg. Co.
Sauerman Bros.

Excavators, Ditch & Trench
Austin Machy. Corp.
Bucyrus Co.
Byers Machine Co., John F.
Fritz Co., Inc., W. G.
Keystone Driller Co.
Marion Steam Shovel Co.
Osgood Co.
Pawling & Harnischfeger Co.
Thew Auto. Shovel Co.

Excavators, Drag-Line
Austin Machy. Corp.
Bucyrus Co.
Byers Machine Co., John F.
Hayward Co.
Lambert Hoisting Eng. Co.
Marion Steam Shovel Co.
Monighan Machine Co.
Osgood Co., The
Pawling & Harnischfeger Co.
Sauerman Bros.
Smith Co., T. L., The

Expanded Metal
Berger Mfg. Co.
Consolidated Expanded Metal Co.
Northwestern Expanded Metal Co.
Truscon Steel Co.

Fence Iron and Wire
Wickwire-Spencer Seel Corp.

Filing Cabinets
Berger Mfg. Co.

Filters, Water, Municipal & Industrial
Amer. Water Softener Co.
International Filter Co.
N. Y. Continental Jewell Filtration Co.
Norwood Engineering Co.
Permutit Co.
Pittsburgh Filter Mfg. Co.
Roberts Filter Mfg. Co.
Scaife & Sons, Wm. B.
Simplex Valve & Meter Co.

Fire Clay
Delaware Clay Products Co.

Fireproof Material and Construction
Berger Mfg. Co.
Detroit Steel Products Co.
General Fireproofing Co.
Keasbey & Mattison Co.
Kinnear Mfg. Co.

Floor Hardener, Concrete
(See Concrete Floor Hardener)

Floor, Wood Block
Barrett Co.
Jennison-Wright Co.
Republic Creosoting Co.

Flooring, Fireproof
Irving Iron Works

Flumes, Iron and Steel
Armco Iron Culvert & Flume Mfgrs. Assoc.
Hardesty Mfg. Co., R.
Petroleum Iron Works

Forgings
Carnegie Steel Co.

Form Clamps
Insley Manufacturing Co.
M. & M. Form Clamp Co.
Universal Form Clamp Co.

Form Tighteners
Marion Malleable Iron Works

Forms—Culvert, Road, Sewer, Tunnel, Etc.
Blaw-Knox Co.
Foote Concrete Mchy. Co.
Hydraulic Steelcraft Co.
Storms Ffg. Co.

Forms, Curb and Gutter
Blaw-Knox Co.

Forms for Walls, Building Construction, Etc.
Berger Mfg. Co.
Blaw-Knox Co.
Hydraulic Steelcraft Co.

Foundations
American Bridge Co.
Lackawanna Steel Co.
MacArthur Concrete Pile & Foundation Co.
Raymond Concrete Pile Co.
Smith, Hauser & MacIsaac
Spencer, White & Prentis
Underpinning & Foundation Co.

Foundry Equipment
Whiting Fdry. & Equip. Co.

Frogs and Switches, Railway
Lakewood Engineering Co.
Ramapo Iron Works

Furnaces, Annealing & Tempering
American Gas Furnace Co.
General Electric Co.

Furnaces, Gas
American Gas Furnace Co

Garbage-Disposal Apparatus
Jeffrey Manufacturing Co.

Gas Producers
Camden Iron Works
Worthington Pump & Machy. Corp.

Gates, Head
Hardesty Mfg. Co., R.

Gates, Sluice
Coffin Valve Co.
Coldwell Wilcox Co.
Crane Co.
Fargo Engineering Co.
Hardesty Mfg. Co., R.
Ludlow Valve Mfg. Co.

Gates, Water
Hardesty Mfg. Co., R.

Gauges, Loss of Head
Simplex Valve & Meter Co.

Gauges, Rate of Flow
Simplex Valve & Meter Co.

Generators, Electric
Allis-Chalmers Mfg. Co.
General Electric Co.

Glass Construction
Detroit Steel Products Co.

Glass, Fireproof
(See Wire Glass)

Governors, Waterwheel
Woodward Governor Co.

Graders, Road
Smith Co., T. L.

Granite
Rockport Granite Co.

Grates, Chain
Green Engineering Co.

Gratings, Subway
Irving Iron Works

Gravel-Washing Plants
Link-Belt Co.
Sauerman Bros.

Hammers, Pneumatic
Chicago Pneumatic Tool Co
Ingersoll-Rand Co.

Hammers, Steam, Pile
(See Pile Hammers, Steam)

Heaters, Concrete, Water
Lakewood Engineering Co.

Hoists, Concrete, Tower
Insley Manufacturing Co.
Lakewood Engineering Co.
Lambert Hoisting Eng. Co.
Ransome Concrete Mach. Co.

Hoists, Contractors':—Electric
Allis-Chalmers Mfg. Co.
Amer. Hoist & Derrick Co.
Byers Machine Co., John F.
Clyde Iron Works
Dobbie Fdry. & Mach. Co.
Flory Mfg. Co., S.
Ingersoll-Rand Co.
Lambert Hoisting Eng. Co.
Lidgerwood Mfg. Co.
Mead-Morrison Mfg. Co.
Minneapolis Steel & Machine Co.
Monighan Machine Co.
Mundy Hoisting Engine Co., J. S.
O. K. Clutch & Machy. Co.
Orr & Sembower, Inc.
Thomas Elevator Co.

Hoists, Contractors': — Gasoline
Gray Iron Fdry. Co.
Lambert Hoisting Eng. Co.
Lidgerwood Mfg. Co.
Mundy Hoisting Engine Co., J. S.
O. K. Clutch & Machy. Co
Schramm & Sons, Inc., Chris. D.
Thomas Elevator Co.

Hoists, Contractors' Steam
Allis-Chalmers Mfg. Co.
Amer. Hoist & Derrick Co.
Byers Machine Co., John F.
Clyde Iron Works
Flory Mfg. Co., S.
Ingersoll-Rand Co.
Lakewood Engineering Co.
Lambert Hoisting Eng. Co.
Lidgerwood Mfg. Co.
Mundy Hoisting Engine Co., J. S.
Orr & Sembower, Inc.
Thomas Elevator Co.
Vulcan Iron Works of Wilkes-Barre, Pa.

Hoists, Pneumatic
Ingersoll-Rand Co.
Whiting Fdry. Equip. Co.

Hoppers, Concrete
Insley Manufacturing Co.
Lakewood Engrg. Co.
Ransome Conc. Mchy. Co.

Hose Air
Penn Flexible Metallic Tubing Co.

Hose, Metallic
Penn Flexible Metallic Tubing Co.

Hose, Steam
Penn Flexible Metallic Tubing Co.

Hose, Suction
Penn Flexible Metallic Tubing Co.

Housing, Industrial
Aladdin Co.

Hydrants
Eddy Valve Co.
Ludlow Valve Mfg. Co.
Norwood Engineering Co.
Rensselaer Valve Co.
Smith Co., A. P.
Wood & Co., R. D.

Inks
Higgins & Co., Chas. M.

Inserts, Concrete
Security Insert Co.
Truscon Steel Co.

Inspecting Laboratories
(See Directory of Engineers)

Instruments, Drawing
Defiance Mfg. Co.
Keuffel & Esser Co.
Weber Co., F.

Instruments, Surveying
Ainsworth & Sons, Wm.
Aloe Co., A. S.
Berger & Sons, C. L.
Buff & Buff Mfg. Co.
Defiance Mfg. Co.
Gurley, W. & L. E.
Keuffel & Esser Co.
Kolesch & Co.
Lietz Co., A.

Iron Work, Structural and Ornamental
Christopher & Simpson Iron Works Co.
Hendrick Mfg. Co.
Irving Iron Works
Ryerson & Sons, Jos. J.
Snead Architectural Iron Works

Jacks, Lifting
McKiernan-Terry Drill Co
Norton Co., A. O.

Joints, Expansion, Paving
Barrett Co.
Truscon Steel Co.

Joints, Filler Paving
Barrett Co.
Standard Oil Co. of N. Y.
Texas Co.

Joints, Flexible Pipe
Central Foundry Co.
Crane Co.
U. S. Cast Iron Pipe & Foundry Co.

Kilns, Lime
Petroleum Iron Works Co.

Lamps, Flood
General Electric Co.

Lath, Expanded Metal
Armco Iron Culvert & Flume Mfgrs. Assoc.
Berger Mfg. Co.
Consolidated Expanded Metal Cos.
General Fireproofing Co.
Hydraulic Steelcraft Co.
Northwestern Expanded Metal Co.
Witherow Steel Co.

Leadite
Leadite Co., Inc., The

Lights, Contractors'
General Electric Co.
Milburn Co., Alex., The

Lime, Hydrated
Kelly Island Lime & Transport Co.

Loaders, Wagon
(See Wagon Loaders)

Lockers, Steel
Berger Mfg. Co.
Lupton's Sons Co., David

Locomotives, Compressed Air
Baldwin Locomotive Wks.
Vulcan Iron Works of Wilkes-Barre, Pa.

Locomotives, Electric
Amer. Locomotive Co.
Atlas Car & Mfg. Co.
Baldwin Locomotive Wks.
Jeffrey Manufacturing Co.
Lakewood Engineering Co.

Locomotives, Gasoline
Baldwin Locomotive Wks.
Bell Locomotive Wks., Inc.
Vulcan Iron Works of Wilkes-Barre, Pa.
Whitcomb Co., Geo. D.

Locomotives, Steam
Amer. Locomotive Co.
Baldwin Locomotive Wks.
Bell Locomotive Works
Davenport Locomotive Works
Vulcan Iron Works of Wilkes-Barre, Pa.

Locomotives, Storage Battery
Whitcomb Co., Geo. D.

Loose Leaf Data
Lefax Co.

Lubricants
Greene Tweed & Co.

Lumber
Industrial Lumber Co.

Lime, Hydrated
Kelly Island Lime and Transport Co.

Manhole Covers
Central Foundry Co.

Manila Drilling Cables
Plymouth Cordage Co.
Whitlock Cordage Co.

Manometers
Simplex Valve & Meter Co.

Metals, Perforated
Chicago Perforating Co.

Meter-Boxes
Pittsburgh Meter Co.

Meters, Boiler Feed Water
Builders Iron Foundry Co.

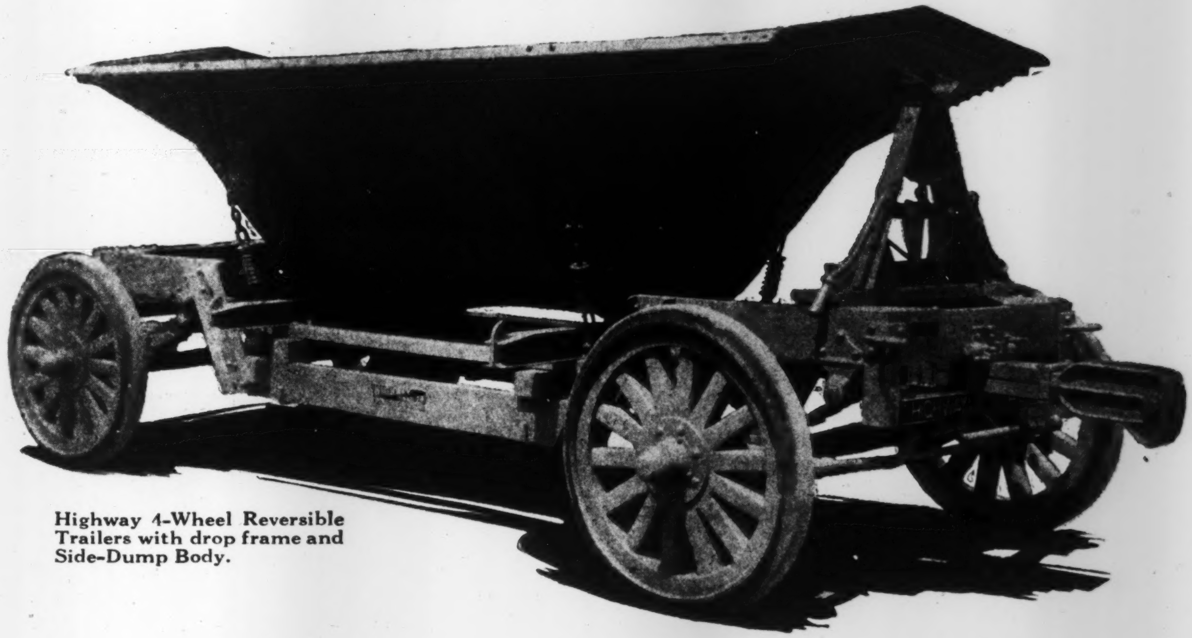
Meters, Current
General Electric Co.
Gurley, W. & L. E.

HIGHWAY TRAILER

EDGERTON WISCONSIN

The Largest Trailer Plant in the World

Instead of Another Truck Add a Highway Trailer



Highway 4-Wheel Reversible Trailers with drop frame and Side-Dump Body.

Each Trailer Saves $1915 to $4000 in First Cost; 90% in Fuel· $5 to $7 Daily in Driver Hire; 80% in Oil, Tires, Repairs

You don't need costly extra trucks to double your hauling capacity.

See how Highway Trailers will meet your added transportation requirements at less than 10% the cost of an extra truck.

On the first cost you save from $1915 on the 1½ ton size to $4000 on the 6 ton size.

But even more important are the savings in operation. Extra drivers are not needed. You haul double loads at less than 10% added cost in fuel, oil, tires and maintenance, over the cost of operating a truck alone.

Highway Trailers are earning net profits of from $35 to $40 a day for hundreds of operators.

It is the only trailer, accepted without design change, by the U. S. Government, which operates more than $1,000,000 worth.

Write for booklet on "How to Save $3,000 to $6,000 a Year Per Unit, with Highway Trailer."

This is Why Many Bankers Now Stipulate Use of Trailers in Financing Truck Sales

	1½ Ton	2½ Ton	4 Ton	6 Ton
Average Truck Costs	**$2700**	**$3600**	**$4150**	**$5700**
Highway Trailer Costs	**$785**	**$995**	**$1325**	**$1695**
Highway Trailer Saves	**$1915**	**$2605**	**$2825**	**$4005**

HIGHWAY TRAILER CO., EDGERTON, WIS.

Meters, Gas and Steam
Builders' Iron Foundry
General Electric Co.
Wallace & Tiernan Co., Inc.

Meter Provers
Pittsburgh Meter Co.

Meters, Venturi
Builders' Iron Foundry

Meters, Water and Oil
Builders' Iron Foundry
Gamon Meter Co.
General Electric Co.
Neptune Meter Co.
Pittsburgh Meter Co.
Simplex Valve & Meter Co.
Thomson Meter Co.
Worthington Pump & Machy. Corp.

Mixers, Concrete
Austin Machy. Corp.
Blaw-Knox Co.
Cement Gun Co.
Foote Concrete Machy. Co.
Gray Iron Foundry Co.
Jaeger Machine Co.
Lakewood Engineering Co.
Oshkosh Mfg. Co.
Ransome Concrete Mach. Co.
Schramm and Son, Inc., Chris. D.
Smith Co., T. L., The
Worthington Pump & Machy. Corp.

Mixers, Grout
Austin Machy. Corp.
Lakewood Engineering Co.
Oshkosh Mfg. Co.
Ransome Concrete Mach. Co.
Union Iron Works

Mixers, Hot
Austin Machy. Corp.

Mixers, Mortar
Austin Machy. Corp.
Jaeger Machine Co.
Lakewood Engineering Co.
Oshkosh Mfg. Co.
Ransome Concrete Mach. Co.

Mixers, Paving
Austin Machy. Corp.
Foote Concrete Co.
Lakewood Engineering Co.
Ransome Conc. Mchy. Co.
Smith Co., T. L., The

Mixers, Pneumatic
Ransome Concrete Mach. Co.

Motors, Electric
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Traction Brake Co.

Motor Truck Bodies
Highway Trailer Co.

Motor Trucks
(See Trucks, Motor)

Oxy-Acetylene Process
Air Reduction Sales Co.
Oxweld Acetylene Co.

Packing, Water-Pipe
Greene, Tweed & Co.
Jenkins Bros.

Paints, Metal Protective
Barrett Co.
Carbolineum Wood Preserving Co.
Minwax Co.
Thompson & Co.
Toch Bros.

Partitions
Detroit Steel Products Co.
Lupton's Sons Co., David

Pavements
Willite Road Constr. Co. of America

Paving Blocks, Brick
National Paving Brick Mfgrs. Assoc.

Paving Blocks, Creosoted Wood
Barber Asphalt Paving Co.
Jennison-Wright Co.
Republic Creosoting Co.
Wyckoff Pipe & Creosoting Co.

Paving Blocks, Granite
Rockport Granite Co.

Penstocks
Lackawanna Steel Co.

Pile-Drivers
Browning Co.
McKiernan-Terry Drill Co.
McMyler Interstate Co.
Union Iron Works

Pile Hammers, Steam
McKiernan-Terry Drill Co.
Union Iron Works

Piles, Concrete
MacArthur Concrete Pile & Foundation Co.
Raymond Concrete Pile Co.

Piles, Creosoted Wood
Jennison-Wright Co.

Piling, Interlocking Steel
Carnegie Steel Co.
Lackawanna Steel Co.
O'Rourke Eng'g Const. Co.

Pipe Bends
East Jersey Pipe Co.

Pipe, Cast-Iron
Amer. Pipe Bending Mach. Co.
Central Foundry Co.
Fox & Co., John
Lynchburg Foundry Co.
U. S. Cast Iron Pipe & Foundry Co.
Warren Fdry. & Mach. Co.
Wood & Co., R. D.

Pipe Coils
Locomotive Superheater Co.

Pipe, Concrete
Lock Joint Pipe Co.

Pipe, Corrugated
Newport Culvert Co.

Pipe Covering Wood
Michigan Pipe Co., The
Standard Wood Pipe Co.
Wyckoff & Sons Co., A.

Pipe, Dredge
Machold & Riddell
Thorn Co., J. S.

Pipe Fittings
Builders' Iron Foundry
Central Foundry Co.
U. S. Cast Iron Pipe and Foundry Co.
Westinghouse Traction Brake Co.

Pipe Joint Compound Pressure
Leadite Co., Inc., The

Pipe, Lap Welded
American Spiral Pipe Wks.

Pipe Lock Bar
East Jersey Pipe Co.

Pipe Lock Joint
Lock Joint Pipe Co.

Pipe, Reinforced Concrete
Lock Joint Pipe Co.

Pipe, Riveted Steel
Amer. Spiral Pipe Wks.
Blaw-Knox Co.
Dravo-Doyle Co.
East Jersey Pipe Co.
Lancaster Iron Works Co.
Machold & Ridell
Petroleum Iron Works Co.
Riter-Conley Co.
Tippett & Wood
Walsh's Holyoke Steam Boiler Works

Pipe Shoes
Marion Malleable Iron Works

Pipe, Spiral Riveted
Abendroth & Root Manufacturing Co.
Amer. Spiral Pipe Wks.
Blaw-Knox Co.

Pipe Threading Machines
Curtis & Curtis Co.

Pipe, Vitrified Clay
Delaware Clay Products Co.

Pipe, Wood
American Wood Pipe Co.
Continental Pipe Mfg. Co
Michigan Pipe Co.
Pacific Tank & Pipe Co.
Standard Wood Pipe Co.
Western Wood Pipe Publicity Bureau
Wyckoff & Sons Co., A.

Poles, Cross Arms, etc.
Jennison-Wright Co.

Poles, Steel Structural
Blaw-Knox Co.
Milliken Bros. Mfg. Co.

Poles, Tubular Steel
Franklin Steel Works

Pressed Steel Products
Berger Mfg. Co.
Blaw-Knox Co.
Hydraulic Steelcraft Co.

Pulverizers
Jeffrey Mfg. Co.
Raymond Bros. Impact & Pulverizer Co

Pumps, Air-Lift
Ingersoll-Rand Co.
McGowan Co., John H.
Sullivan Machinery Co.

Pumps, Boiler-Feed, Steam
Dean Bros. Steam Pump Works
Earle Gear & Machine Co.
Lea-Courtenay Co.
McGowan Co., John H.
Worthington Pump & Machy. Corp.

Pumps, Centrifugal and Multi Stage High Lift
American Well Works
Camden Iron Works
De Laval Steam Turbine Co.
Domestic Engine & Pump Co.
Earle Gear & Machine Co.
Erie Pump & Engine Co.
Goulds Mfg. Co.
Keystone Driller Co.
Lawrence Pump & Engine Co.
Lea-Courtenay Co.
McGowan Co., John H.
Manistee Iron Works
Midwest Engine Co.
Morris Machine Works
Smith Co., T. L., The
Taber Pump Co.
Worthington Pump & Machy. Corp.

Pumps, Contractors'
American Well Works
Domestic Engine & Pump Co.
Edson Manufacturing Co.
McGowan, John H.
Parker, A. A.
Schramm and Son, Inc., Chris. D.
Smith Co., T. L., The
Van Nouhuys Mach. Wks.
Waldo Bros. & Bond Co.

Pumps, Deep Well
American Well Works
Cook, A. D.
Domestic Eng. & Pump Co.
Goulds Mfg. Co.
Keystone Driller Co.
McGowan Co., John H.
Worthington Pump & Machy. Corp.

Pumps, Diaphragm
Boston & Lockport Block Co.
Domestic Eng. & Pump Co.
Edson Manufacturing Co.
Goulds Mfg. Co.
McGowan Co., John H.
Manistee Iron Works
Smith Co., T. L., The
Van Nouhuys Mach. Wks.
Waldo Bros. & Bond Co

Pumps, Dredging and Sand
Erie Pump & Engine Co.
Lawrence Pump & Eng. Co.
McGowan Co., John H.
Marion Steam Shovel Co.
Morris Machine Works
Parker, A. A.
Worthington Pump & Machy. Corp.

Pumps, Elevator
McGowan Co., John H.
Worthington Pump & Machy. Corp.

Pumps, Power
Camden Iron Works
Cook, A. D.
Dean Bros. Steam Pump Works
Domestic Eng. & Pump Co.
Fairbanks-Morse Co. of Chicago
Fairbanks-Morse Co. of N. Y.
Goulds Mfg. Co.
Lea-Courtenay Co.
McGowan Co., John H.
Manistee Iron Works
Sterling Engine Co.
Worthington Pump & Machy. Corp.

Pumps, Underwriters Centrifugal
Allis-Chalmers Mfg. Co.
Earle Gear & Machine Co.
Lea-Courtenay Co.
McGowan Co., John H.
Manistee Iron Works
Sterling Engine Co.

Purifiers, Feed-Water
N. Y. Continental Jewell Filtration Co.
Norwood Engineering Co.

Rail and Rail Joints, Fastening and Specialties
Carnegie Steel Co.
Lackawanna Steel Co.

Railroad Ditchers
Ball Engine Co.
Marion Steam Shovel Co.
Osgood Co., The

Railways, Industrial
Lakewood Engineering Co.

Recorders, Water Stage
Gurley, W. & L. E.

Reinforcing, Bar Couplings
Marion Malleable Iron Works

Reinforcing, Concrete
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Reinforcing Metal for Concrete Work
Berger Mfg. Co.

River and Harbor Work
Raymond Concrete Pile Co.

Road Oilers, Pressure
Austin Machy. Corp.
Universal Road Machy. Co.

Road Oils and Preservatives
Barber Asphalt Paving Co.
Barrett Co.
Standard Oil Co. of Chicago
Standard Oil Co. of N. Y.

Road Rollers, Gasoline and Steam
Buffalo-Springfield Roller Co.
Erie Machine Shops

Rolls, Crushing
Allis-Chalmers Mfg. Co.
Jeffrey Manufacturing Co.

Roofing, Metal
American Sheet & Tin Plate Co.
Berger Mfg. Co.

Roofing, Prepared
Barrett Co.
Stark Rolling Mill Co.

Roofing, Tile
American Cement Tile Manufacturing Co.
Federal Cement Tile Co.

Rope, Manila, Hoisting, Transmission
Plymouth Cordage Co.
Whitlock Cordage Co.

Rope, Wire, Transmission Hoisting and Haulage
American Steel & Wire Co.
Leschen & Sons Rope Co., A. Co.
Moon Co., Geo. C.
Roebling Sons Co., John A.
Waterbury Co.
Wickwire-Spencer Steel Corp.

Sash Operating Apparatus
Detroit Steel Products Co.
Lupton's Sons Co., David

Sash, Steel, Window
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Screens, Rotary
Smith Engineering Works

Screens, Sand, Gravel and Coal
Chicago Perforating Co.
Hendrick Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Company
Webster Mfg. Co.
Wickwire-Spencer Steel Corp.

Screens, Water Intake
Link-Belt Co.

Screens, Well
American Well Works

Searchlights
General Electric Co.

Second-Hand Equipment
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Sewage Disinfection
Wallace & Tiernan Co., Inc.

Sewage Disposal
Dorr Co.
Pacific Flush Tank Co.

Sewer Cleaning Machinery
Turbine Sewer Mach. Co.

Sewer Rods
Turbine Sewer Mach. Co.

Shafting
Medart Patent Pulley Co.

Sharpening Machines, Drill Bit
Ingersoll-Rand Co.

Sheaves
Haiss Mfg. Co., Geo.

Sheets, Iron and Steel
Stark Rolling Mill Co.

Sheets, Roofing & Siding
American Sheet & Tin Plate Co.
Armco Iron Culvert & Flume Mfgrs. Assoc.
Stark Rolling Mill Co.

Shelving, Steel
Berger Mfg. Co.

Shoveling Machines
Lake Superior Loader Co

Shovels, Electric
Ball Engine Co.
Bucyrus Co.
Keystone Driller Co.
Marion Steam Shovel Co
Thew Auto. Shovel Co

Shovels, Gasoline
Marion Steam Shovel Co
Thew Auto. Shovel Co.

Shovels, Steam
Ball Engine Co.
Browning Co.
Bucyrus Co.
Keystone Driller Co.
Marion Steam Shovel Co.
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Siphons, Flush Tank
Pacific Flush Tank Co.

Skips, Stone
Insley Manufacturing Co
Lakewood Engineering Co.

Skylights
Lupton's Sons Co., David

Slabs, Cement Roofing
Federal Cement Tile Co.

Slag
Carnegie Steel Co.

Spreaders, Ballast
Bucyrus Co.

Sprinklers and Sweepers, Street
Austin Machy. Corp.

Standpipes, Tanks and Towers
American Bridge Co.
Blaw-Knox Co.
Caldwell Co., W. E.
Chicago Bridge & Iron Works
Pacific Tank & Pipe Co.
Petroleum Iron Works
Pittsburgh-Des Moines Steel Co.
Tippett & Wood

Steam Specialties
Jenkins Bros.

Steel Shelving
Lupton's Sons Co., David

Steel Plate Construction
American Bridge Co.
Bethlehem Steel Bridge Corp.
Blaw-Knox Co.
Caldwell Co., W. E.
Chicago Bridge & Iron Works
Coatsville Boiler Works
Dravo-Doyle Co.
East Jersey Pipe Co.
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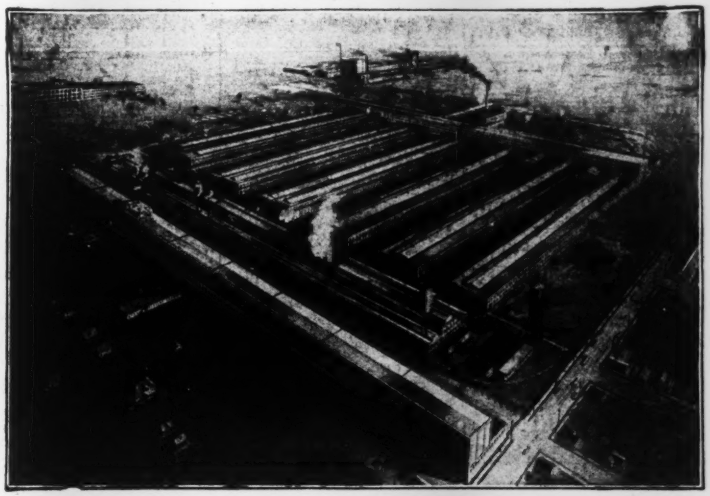
Lackawanna Steel Co.
Lancaster Iron Works, Inc.
Memphis Steel Const. Co. of Pa.
Petroleum Iron Works
Pittsburgh-Des Moines Steel Co.
Tippett & Wood
Union Iron Works
Vulcan Iron Works of N. J.
Walsh's Holyoke Steam Boiler Works
Williams Co., G. H.
Youngstown Boiler and Tank Co.

Steel, Structural
American Bridge Co.
Belmont Iron Works
Berlin Construction Co.
Bethlehem Steel Bridge Corp.
Blaw-Knox Co.
Boston Bridge Works
Carnegie Steel Co.
Champion Bridge Co.
Christopher & Simpson Iron Works Co.
Dravo-Doyle Co.
Eastern Bridge & Structural Co.
Fisher & Marks Co.
Fort Pitt Bridge Works
Franklin Steel Works
Kellogg Structural Steel Co.
Kenwood Bridge Co.
King Bridge Co.
Lackawanna Bridge Co.
Lackawanna Steel Co.
Lakewood Engineering Co.
Louisville Bridge & Iron Co.
McClintic-Marshall Co.
Memphis Steel Const. Co. of Pa.
Milliken Bros. Mfg. Co.
Milwaukee Bridge Co.
Minneapolis Steel & Machinery Co.
Missouri Valley Bridge & Iron Co.
Morava Construction Co.
Mount Vernon Bridge Co.

One Responsibility

The axiom "One Responsibility" adopted by the Allis-Chalmers Manufacturing Company will be fully appreciated by everyone who desires to purchase a complete power plant and place the order with one firm which designs and builds the complete equipment in its own works. This saves the customer a multiplicity of negotiations with different manufacturers to collect various apparatus for a complete plant, the functions of which are not designed and built with reference to each other.

The purchaser can avoid annoying and sometimes expensive complications by placing his contract for complete units with a responsible manufacturing company with the full knowledge that same will be designed and built by one engineering staff, one shop organization centering its entire effort upon one goal—a complete Unit with each part designed and built to suit the characteristics of the driven and driving medium to obtain maximum efficiency and satisfactory operation.



WEST ALLIS, WISCONSIN, PLANT

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Air Compressors
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Centrifugal Pumps
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Crushing Machinery
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Electrical Machinery
Farm Tractors
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Gas Engines
Hydraulic Machinery
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Rolling Mill Machinery
Steam Engines
Steam Hoists
Steam Turbines
Sugar Machinery

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ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

National Pressed Steel Co.
Penn. Bridge Co.
Phoenix Bridge Co.
Pittsburgh-Des Moines Steel Co.
Riverside Bridge Co.
Shoemakers-Satterthwait Bridge Co.
Snare & Triest Co.
Snead Architectural Iron Works
Toledo Bridge & Crane Co.
Virginia Bridge & Iron Co.
Wisconsin Bridge & Iron Co.

Steel, Tool
Carnegie Steel Co.

Strainers, Well
Cook, A. P.

Stokers
Babcock & Wilcox Co.
Green Engineering Co.

Superheaters
Locomotive Superheater Co.

Switchboards
General Electric Co.

Tables & Boards, Drawing
Dietzgen Co., Eugene.
Economy Drawing Table & Manufacturing Co.
Hamilton Mfg. Co.

Tampers, Power
Pawling & Harnischfeger Co.

Tanks, Air Compressor
East Jersey Pipe Co.
Petroleum Iron Works
Westinghouse Traction Brake Co.

Tanks, Oil
Blaw-Knox Co.
Lancaster Iron Works Co.
Riter-Conley Co.

Tanks, Steel
(See Steel Plate Construction)

Tanks, Wood
American Wood Pipe Co.
Caldwell Co., W. E.
Continental Pipe Mfg. Co.
Pacific Tank & Pipe Co.

Tapes, Steel and Metallic
Dietzgen Co., Eugene
Hamilton Mfg. Co.
Keuffel & Esser Co.

Tar
Barrett Co

Testing Laboratories
(See Directory of Engineers)
Fuller Engineering Co.

Ties, Creosoted Wood
Jennison-Wright Co.

Ties, Steel
American Bridge Co.
Carnegie Steel Co.

Tile, Concrete Building
Federal Cement Tile Co.

Tile, Roof Cement
American Cement Tile Manufacturing Co.
Federal Cement Tile Co.

Towers, Radio
Blaw-Knox Co.
Milliken Bros. Mfg. Co

Towers, Transmission
Blaw-Knox Co.
Lakewood Engineering Co.
Milliken Bros. Mfg. Co.
Riter-Conley Mfg. Co.

Tracing Paper
Defiance Mfg. Co.
Vincent, Geo.

Track, Industrial and Portable
Easton Car & Const. Co.
Lakewood Engineering Co.

Tractors
Austin Machy. Corp.
Cleveland Tractor Co.
Eagle Wagon Works
Highway Trailer Co.
Holt Mfg. Co.
Lakewood Engineering Co.

Tractors, Storage Battery
Lakewood Engineering Co.

Trailers
Eagle Wagon Works
Highway Trailer Co.
Lakewood Engineering Co.

Transits and Levels
Ainsworth & Sons, Wm.
Beckmann Co., L.
Berger & Sons, C. L.
Buff & Buff Mfg. Co.
Defiance Mfg. Co.
Kolesch & Co.
Penn. Instrument Co.

Track Fastenings
Gurley, W. & L. E.

Transformers
General Electric Co.

Transmission Machinery, Power
General Electric Co.
Leffel & Co., Jas.
Link-Belt Company

Treads Safety
Concrete Steel Co.
Irving Iron Works

Trolleys I-Beam
Brown Hoisting Machy. Co.
Whiting Fdry. Equip. Co.

Trucks and Trailers, Factory
Lakewood Engineering Co.

Trucks, Motor
Chicago Pneumatic Tool Co.
Cleveland Tractor Co.
Eagle Wagon Works
Packard Motor Car Co.
Service Motor Truck Co.

Tunnel Liner Plates
Blaw-Knox Co.
Hydraulic Steelcraft Co.

Turbines, Hydraulic Impulse and Reaction
Allis-Chalmers Mfg. Co.
Leffel & Co., James
Pelton Water Wheel Co.

Turbines, Steam
Allis-Chalmers Mfg. Co.
De Laval Steam Turbine Co.
General Electric Co.
Midwest Engine Co.

Turbo Generators, Steam
Allis-Chalmers Mfg. Co.

Turntables
Lakewood Engineering Co.
Whiting Fdry. Equip. Co.

Underpinning
O'Rourke Eng'g Const. Co.
Smith, Hauser & MacIsaac
Underpinning & Foundation Co.

Unloaders, Car
Bonney Supply Co.

Valves, Air, Water, Steam and Gas
Coldwell-Wilcox Co.
Crane Co.
Golden-Anderson Valve Specialty Co.
Hardesty Mfg. Co., R.
Ludlow Valve Mfg. Co.
Norwood Engineering Co.
Rensselaer Valve Co.
Simplex Valve & Meter Co.
Smith Co., A. P.
Westinghouse Traction Brake Co.

Valves, Altitude
Golden-Anderson Valve Specialty Co.
Ludlow Valve Mfg. Co.

Valves, Angle, Check, Gate and Globe
Golden-Anderson Valve Specialty Co.
Jenkins Bros.
Ludlow Valve Mfg. Co.
Simplex Valve & Meter Co.
Westinghouse Traction Brake Co.

Valves, Automatic
Golden-Anderson Valve Specialty Co.
Ludlow Valve Mfg. Co.
Westinghouse Traction Brake Co.

Valves, Float
Golden-Anderson Valve Specialty Co.

Valves, Regulating
Golden-Anderson Valve Specialty Co.
Ludlow Valve Mfg. Co.
Simplex Valve & Meter Co.
Westinghouse Traction Brake Co.

Valves, Return
Golden-Anderson Valve Specialty Co.

Valves, Safety
Golden-Anderson Valve Specialty Co.
Ludlow Valve Mfg. Co.
Westinghouse Traction Brake Co.

Valves, Sluice
Coffin Valve Co.
Eddy Valve Co.
Fargo Engineering Co.

Ventilators
Lupton's Sons Co., David

Wagons, Asphalt
Eagle Wagon Works

Wagons, Dump Auto
Eagle Wagon Works
Service Motor Truck Co.

Wagons, Garbage
Eagle Wagon Works

Wagon Loaders
Austin Machy. Corp.
Bonney Supply Co.
Gifford-Wood Co.
Haiss Mfg. Co., Geo.
Jeffrey Manufacturing Co.
Lee Loader & Body Co.
Link-Belt Company.
Portable Machy. Co.

Washers, Cut Cast Malleable
Smith Engineering Works

Water Main Cleaning
National Water Main Cleaning Co.

Waterproofing Compounds and Material
Anti-Hydro Waterproofing Co.
Barrett Co.
General Fireproofing Co.
Granitex Co.
Master Builders Co.
Minwax Co.
Sonneborn Sons, Inc., L.
Toch Bros.

Water Purification
Dorr Co.
Mathieson Alkali Works
Wallace & Tiernan, Inc

Water Softeners
Amer. Water Softener C
International Filter Co
Mathieson Alkali Works
N. Y. Continental Jewe Filtration Co.
Permutit Co.
Roberts Filter Mfg. Co
Scaife & Sons, W. B.

Water Sterilization
Wallace & Tiernan, Inc

Water Wheels, Impulse and Reaction
Leffel & Co., Jas.
Pelton Water Wheel Co

Welding & Cutting Apparatu
Air Reduction Sales Co
General Electric Co.
Milburn Co., Alex., The
Oxweld Acetylene Co.

Well Drilling Machines
American Well Works

Winches, Ship, Hand, Steam and Electric
Brown Hoisting Machy. Co
Dobbie Fdry. & Machy. Co
Flory Mfg. Co., S.
Lakewood Engineering Co
Lambert Hoisting Eng. Co
Lidgerwood Mfg. Co.

Window Sash Steel
Detroit Steel Products Co
Lupton's Sons Co., David

Wire and Cable, Electrical
American Steel & Wire Co

Wire Glass
Mississippi Wire Glass Co

Wire, Mesh Reinforced
Wickwire-Spencer Steel Corp.

Wire Rope
(See Rope, Wire)

Wood Casings
Michigan Pipe Co., The

Wood Preservatives
Barrett Co.
Carbolineum Wood Preserving Co.
Northeastern Co.
Ohio Wood Preserving Co.
Republic Creosoting Co.
S. P. F. Wood Preserving Co.

Wrenches
Greene, Tweed & Co.
Lowell Wrench Co.

If you are using anything in your work which you do not find listed in this Buyers' Guide, we would appreciate your writing us about it.

WINDOW WALLS
THEIR COST
THEIR ADVANTAGES

Banister Shoe Factory, Newark, N. J., and section of interior showing light at the bench through Fenestra WindoWalls

Frank Hill Smith, Inc., Engineers

Send For This Book

Published for your information. It gives facts and comparative cost figures in detail. It summarizes just what you want to know about WindoWalls. Drop us a letter today and we will mail it to you.

WindoWalls—

"Sunlight and Air"

Sunshine at the bench—daylight around the work—free ventilation—these encourage careful workmanship, speed production and promote good feeling.

This is exemplified in its highest development in the Banister Shoe Factory, at Newark, N. J.

And the part that Fenestra WindoWalls have fulfilled in these larger aspects of essentially good building, is significantly illustrated in the following letter from Mr. James B. Banister, president:

> **"We are complimented continually for the fine building we occupy, which some think almost too nice for a shoe factory.**
>
> **"But more of our working hours are spent behind these glass windows than any other place, and we feel that we are to be congratulated on having such pleasant surroundings for our daily toil.**
>
> **"Sunlight and air are the two natural elements to uplift humanity, and we have these to the fullest degree.**
>
> **"Anybody who contemplates building would be very unwise to consider old-fashioned, little windows, and we are very confident that no particular of our new factory has given us any greater satisfaction than the windows that let the blessed sunshine in."**

Fenestra WindoWalls are the least expensive of all wall materials—because they make light cost less and produce more.

Detroit Steel Products Company, 2042 E. Grand Blvd., Detroit
Boston New York Philadelphia Washington Chicago San Francisco Hartford Buffalo Newark Richmond Baltimore
Canadian Metal Window and Steel Products, Ltd., Toronto, Ontario, Canada

Fenestra
STEEL WINDOWALLS

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AMERICAN
PUMPS

PRODUCTS:

Centrifugal Pumps of every description from a small pump with ¾ in. openings and a capacity of 10 gals. per minute to a 60-in. pump with a capacity of 100,000 gals. per minute, for water works, irrigation drainage, mine, fire protection, quarry, dredge, hydraulic giant, caisson, foundation sump, trench, bilge, boiler feed, condensing, street flushing and general purpose pumping.

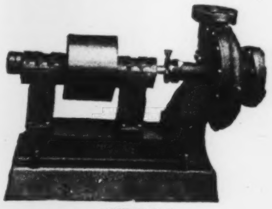
Deep Well Turbine Centrifugal Pumps for pumping wells 12 in. and larger in diameter and to 250 ft. in depth.

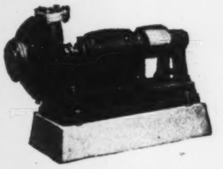
Deep Well Plunger Pumps, Single Acting, Double Acting and 2-stroke.

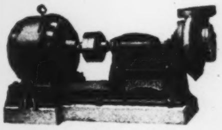
"AMERICAN" CENTRIFUGAL PUMPS:

These pumps are built in a large number of standard types, and in addition special pumps are designed and built to meet particular conditions.

Centrifugal pumps are made with either open type or enclosed type impellers, with or without diffusers and with single suction or double suction in single stage pumps. All double suction pumps and some single suction pumps are made with split casing, so designed that the cap, or cover, of the casing can be removed to expose internal working parts without disturbing pipe connections.


TYPE EE
Single stage, belt driven, high pressure, for heads to 125 ft.


TYPE P
High pressure, horizontal, with grit-proof bearing for total heads to 200 ft.


TYPE PMD
High pressure, single stage, horizontal centrifugal with grit-proof bearing. Motor driven, for total heads to 200 ft.

TYPE N
High pressure, two stage turbine centrifugal pump, with pulley for belt drive.

Characteristics: The important features of "American" centrifugals are: skillful designing so that they attain high efficiencies with flat efficiency curves, thus being economical in use through a wider range of delivery; use of good material in their construction; careful machining and accurate adjustments.

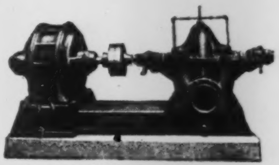
Bearings are ring oiled from oil reservoirs. Impellers are given both rotative and end thrust balance. In single suction, open impeller type pumps, the sides and edges of impeller and interior of casing are carefully machined and closely adjusted at sides to prevent leakage.

Double suction types are fitted with labyrinth rings around suction openings to reduce leakage to a minimum. Multistage, enclosed impeller types are designed to have fewest points of leakage back to suction openings.

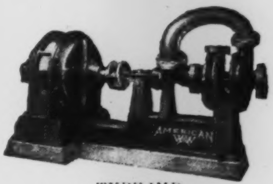
Drive: "American" centrifugal pumps are equipped with plain pulley for belt drive, with grooved sheave for rope drive, steam engine, gasoline engine, electric motor, steam turbine, or with hydraulic turbine.

Pumps are also supplied unmounted with flexible shaft coupling for any power, or mounted on base, but without attached power.

Catalogs: Catalogs describing "American" Pumps will be sent on request. No. 149 describes Centrifugals; No. 130A, Deep Well Plunger Pumps.


TYPE DSMD
High pressure, double suction single stage, split volute, for total heads to 125 ft.

TYPE H
High pressure, 2-stage, vertical shaft, for total heads to 150 ft.



TYPE IMD
High pressure, 2-stage, motor driven, for total heads to 250 ft.

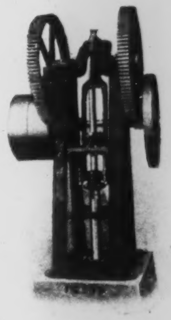
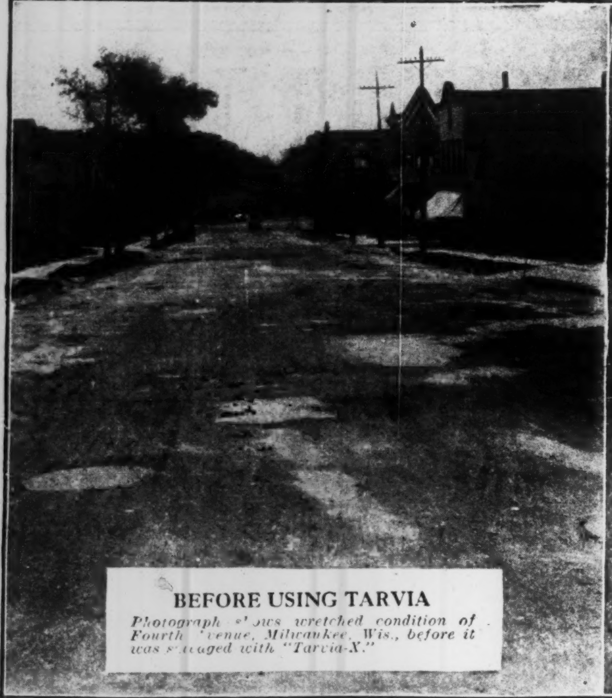


FIG. 110B
Power head for deep well plunger pump.

THE AMERICAN WELL WORKS, Aurora, Ill.

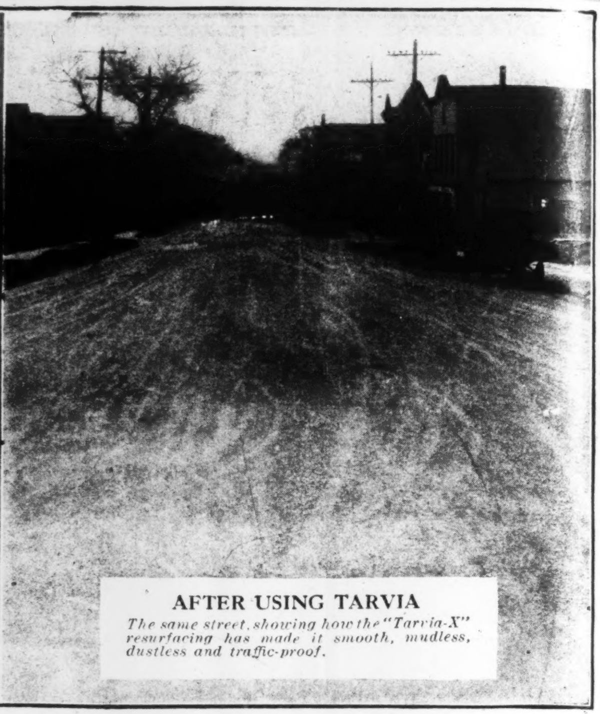
Chicago Office: First National Bank Bldg.

DISTRICT SALES AGENCIES: New York City, Philadelphia, Pa.; Pittsburgh, Pa.; St. Paul, Minn.; San Francisco, Cal.; Los Angeles, Cal.; Lincoln, Nebr.; Birmingham, Ala.; Artesia, N. Mex.; Dallas, Tex.; Montreal, Can.; Chatham, Ont., Can.; Edmonton, Alta; Salt Lake City, Utah; Denver, Colo.; Kansas City, Mo.; Joplin, Mo.; St. Louis, Mo.; Calgary, Alta.



BEFORE USING TARVIA

Photograph shows wretched condition of Fourth Avenue, Milwaukee, Wis., before it was salvaged with "Tarvia-X."



AFTER USING TARVIA

The same street, showing how the "Tarvia-X" resurfacing has made it smooth, mudless, dustless and traffic-proof.

To Get Good Roads—Cheaply—Quickly—Save the Roads You Have!

MILES and miles of good gravel and macadam roads throughout the country can be restored to meet modern traffic requirements. The way to do this is to utilize the existing road as a foundation for a traffic-proof Tarvia top. And where crushed stone or slag is available, the community so favored not only can save its roads but *save* considerable *money* in the bargain.

Many progressive communities recognize this fact, and are carrying out an extended *road salvage program*, rather than build new roads at present exorbitant prices.

For example, the City of Milwaukee has in this way transformed 1,700,000 square yards of water-bound macadam into splendid modern streets to the complete satisfaction of both the city authorities and the traveling public.

Whether you require a good binder for new construction, a dust-preventive, a patching or maintenance material, Tarvia in its various grades, provides an economical and satisfactory solution.

Tarvia Roads are durable, dustless and mudless. They are also waterproof and frost-proof and require a minimum of upkeep expense.

Illustrated Booklet, telling about the various Tarvia treatments, free on request.

Tarvia

Preserves Roads~Prevents Dust

Special Service Department

This company has a corps of trained engineers and chemists who have given years of study to modern road problems. The advice of these men may be had for the asking by any one interested. If you will write to the nearest office regarding road problems and conditions in your vicinity, the matter will be given prompt attention.

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